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EDITORIAL ANNOUNCEMENTS

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It consists of most of the reading pages and all of the advertisement pages of the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Transport and Railroad Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

VOL. XXXVIII. No. 21. FRIDAY, MAY 26, 1905.

CONTENTS

The abandonment of the community of interest principle, as suggested in a recent editorial in the *Railroad Gazette*, has received perhaps the most striking illustration possible in the changes made last week in the Northern Pacific directorate, which are noted in another column. It will be remembered that at the time of the compromise between the Hill and Harriman parties shortly after the Northern Pacific corner and before the Northern Securities Company was formed, the task of so making up the directorate of the Northern Pacific that all parties interested should be given adequate representation was assigned to Mr. J. P. Morgan. As announced by him on July 18, 1901, five members of the Northern Pacific board, who represented ownership of the property, retired and their places were filled by James J. Hill, president of the Great Northern; E. H. Harriman, chairman of the Executive Committee of the Union Pacific; William Rockefeller, director of the Chicago, Milwaukee & St. Paul; H. McKay Twombly, director of the Chicago & North-Western, and Samuel Rea, vice-president of the Pennsylvania. The following express statement of the purpose of these selections was made by Mr. Morgan in his letter nominating the board: "Every important interest will have its representative, who will be brought into close touch with the situation as a whole, and there should be no difficulty in reaching a conclusion that will be fair and just to all concerned and tend to the establishment of permanent harmony among the different lines." The plan was to remove the Northern Pacific as a disturbing element in the trans-continental situation by giving representation to those interested in the policy of the road as distinguished from those interested in its ownership. Mr. Hill and Mr. Harriman, although large owners, were put on the board particularly because they were at the head of competing trans-continental lines. Mr. Rockefeller and Mr. Twombly stood for the granger lines, and each of them in addition represented indirectly the railroad investments of the Rockefeller and Vanderbilt interests. Mr. Rea represented the Pennsylvania and its controlled lines. Already on the board were Samuel Spencer, president of the Southern; Eben B. Thomas, president of the Lehigh Valley, and James Stillman, director, among other roads, of the Baltimore & Ohio, Chicago & Alton and Delaware, Lackawanna & Western. Directly or indirectly, the management of Northern Pacific represented control of a large majority of the country's railroad mileage. In the report of the Industrial Commission, the election of this board was pointed out as "the clearest instance of this new policy (community of interest) in railroad management." The theory is familiar enough, that by the representation of outside interests on a railroad's board, not only would the road itself be well operated because of the large railroad experience of the type of men selected, but, what was more important to the railroad world, would be removed as a potential disturber of the peace. In spite of the complication of Northern Pacific's history by its connection with the Northern Securities Company, it is hard to see in the retirement from the board of Messrs. Harriman, Rockefeller, Stillman, Twombly, Rea, Spencer and Thomas and their replacement by men who are all of them owners or direct representatives of the owners of Northern Pacific, anything else but an open admission that community of interest is a failure. To-day Mr. Harriman represents every trans-continental line in the United States, except the Great Northern and Northern Pacific. Mr. Stillman and Mr. Rockefeller are his allies, and the latter, as at the time of his appointment to the Northern Pacific board, is a director of the Chicago, Milwaukee & St. Paul, which is actively threatening to become a trans-continental line by building to a Great Northern-Northern Pacific port. As a whole, the group of retiring members stand for, if anything, a stronger and more representative control of the country's railroad mileage than they did in 1901. These men are the very ones who in that year were selected to establish "permanent harmony among the different lines." The new directors are the owners of the property. There could hardly be a more complete reversal of the argument on which in 1901 Mr. Morgan made his selection. Apparently both he and Mr. Hill have had it proved to their satisfaction that a railroad can be run better for all concerned by men who directly represent its owners than by very practical railroad men from other interested lines.

ARMOUR TESTIMONY BEFORE THE SENATE COMMITTEE

President George P. Robbins, of the Armour Car Lines Company, testified before the Senate Committee on Interstate Commerce May 16 that the company had twenty or thirty exclusive contracts with railroads for transportation of fruit, and he acknowledged a monopoly of that traffic in certain localities, specifically in parts of the West and South. He admitted that wherever these exclusive contracts applied producers and shippers of fruit had to accept the rates made by the Armours. He maintained stoutly that his company was a private one, and was not subject to the interstate commerce laws, and did not want to be. He testified that the Armours have 200 articles classified as packing-house products, which are carried in Armour cars. Mr. Robbins declined to testify regarding the earnings of the car lines. He denied that the Armours were interested in any of the fruit companies in California or that they had a monopoly of the transportation of California fruit, but acknowledged that his company had a monopoly of fruit transportation in the Pere Marquette region and in Georgia and Florida. The Armours had exclusive contracts with all the railroads in the South Atlantic coast states, in East Tennessee, on certain roads in Missouri and Arkansas, and on the Southern Pacific. The Santa Fe was a competing line in the fruit business in California.

In this clear and frank statement Mr. Robbins practicaly threw down the gauntlet for Congress. He said that all other shippers got the same rates in the Armour cars that the Armours did, but he neglected to call the attention of the committee to the fact that the absurd charges for icing, etc., con-

stitute a very substantial rebate to the company that owns the cars. No two points have been brought out more strongly in the mass of testimony presented to the commission than that open illegal rebates at the present time are exceedingly scarce—so scarce that as a feature in the situation they can be called non-existant—but that rebates secured to large private companies by methods which are technically perfectly legal, such as the private car method or the terminal railroad method, flourish exceedingly. The remedy for the private car evil seems to be an extremely simple one. There are plenty of laws to require that a common carrier's charges must be reasonable. What is necessary, therefore, is that the private car lines be included in the category of common carriers, from which they are at present excluded. The private car lines hold a club over the railroad manager to-day which prevents him from making vigorous reforms in this notorious abuse, and Congress can make rates till doomsday without relieving the shipper in private cars that do not come within the purview of the law. The remedy here is a perfectly simple one, which involves no radical experiment. Unfortunately, the remedy for the terminal railroad abuse is not so simple.

BRITISH STANDARD RAIL SECTIONS.

The Engineering Standards Committee of Great Britain has recently issued a set of standard specifications and sections for flat-bottom or T rails, which, together with the standard specifications and sections for bull-head rails issued last fall, completes an undertaking very like that which the American Society of Civil Engineers so successfully carried out in this country in the early nineties. The sub-committee on rails, of which Mr. James C. Inglis, Great Western Railway, is chairman, has spent four years in preparing the specifications and designing the sections now issued as standard, and its members are to be congratulated on the work they have done in bringing about more uniform requirements of test and acceptance by the railroad companies and the resulting betterments and economies in mill practice by the rail makers. Their task has not been quite so difficult, perhaps, as that which confronted the advocates of standard rail sections in America 15 or 20 years ago, but they have undoubtedly had to struggle with the same wide diversity of ideas and opinions, and to overcome stubborn resistance on the part of a few to reach a compromise that would be acceptable to all. With the memory of the long and heated controversy which preceded the adoption of a standard form of rail section in the United States still fresh in our mind we can appreciate the work which the committee has done, while at the same time we claim the privilege of criticizing some features of the design as seen in the light of American rail-making practice.

The basis of the design of the section for T rails is the American Society of Civil Engineers' standard section, the principal dimensions of height, width of base and width of head being the same for corresponding weights. The same general form of head with 12-in. top radius and vertical sides has been preserved, but here the similarity ends. Instead of a 5-16 in. radius for the top corner of the head this has been increased to ⅜ in. in the T rail and to ½ in. in the bull-head rail. The consensus of opinion among American engineers is in favor of a small radius at this point, for with vertical sides to the head it is evident that there is less grinding action of the wheel flange against the rail than with a corner having a larger radius which fits the contour of the throat of the wheel flange more closely. While it is true that the rails on curves do eventually wear with large radius corners and sloping sides, the greater amount of metal in the head having small radius corners prolongs the life of the rail. Mr. Sandberg, who designed the so-called "Goliath" rail section some years ago, was an advocate of the large radius corner, but he raised the distinction that with the short rigid truck wheel base of American rolling stock it was possible to use a sharper corner than with the longer rigid wheel base of European rolling stock. It is doubtful if this distinction has any real bearing on the case, however. If any criticism can be made of the design of T rails in this one particular it is that the same radius of top corner was not preserved in both the T rail and the bull-head rail. If there was any reason for making one ⅜ in. and the other ½, we are at a loss to understand it clearly.

Making the sides of the web vertical instead of in a curve of 12 in. radius is another departure from the Am. Soc. C. E. section. The minimum thickness of the web is the same for corresponding weights of rail, and while the curved sides do not add any strength to the web they put additional metal at the junction of the thin web and the large mass in the head and base. At this point the maximum cooling strains occur, and it is essential to have as much metal as possible, and to give it heavy work in the rolls. Rails with webs having vertical sides are no longer made in any quantity in this country for that reason.

Still another change for which there seems to be no apparent reason is in making the angle of the under side of the head 14 deg. instead of 13 deg., as in the Am. Soc. C. E. standard section. The difference is in itself small and insignificant, but sufficient to cause a poor fit of the angle bars if any attempt is made to use bars rolled for American sections. In the bull-head rails this angle is 20 deg., so that obviously there has been no attempt to make it the same for both types of rails. In the same way, the angle of the top of the base has been made 14 deg. for the width of the head and 5 deg. 43 min. for the remainder of the width to the edge. Possibly this was done to preserve a symmetrical section of the head and base, and at the same time to prevent making the base too thin at the edges. Or, it may be the committee had in mind using screw spikes exactly similar to those used by the Eastern Railway of France, which is laid with T rails having this same design of base with a top surface nearly flat at the edge.

The net result of these cnanges is that a new rail section has been designed, which has as a basis a design which has been rolled and laid in track for 12 years or more with excellent results, but which has some slight defects. The changes which have been made will not, we believe, overcome these defects for the new section is not more symmetrical than the old, nor does it require more work in the rolls. Just why all the essential proportions and dimensions of the Civil Engineers' were retained, and at the same time enough minor differences embodied to make it necessary to have an entirely different set of rolls to turn out the two sections, is not altogether easy to explain. The most plausible reason seems to be that the committee yielded to pressure brought to bear by English rail makers in the hope that American competition could be forestalled to a great extent if the rail makers here were compelled to make new rolls in order to enter the foreign market, which at best holds out but a small margin of profit. If this has been the case, the Engineering Standards Committee has taken a backward step in its commendable endeavor to unify engineering practice by standardizing as far as possible the details of construction material.

THE DIFFERENTIAL ARBITRATION.

On April 27, in response to the request that it act as arbitrator, the Interstate Commerce Commission gave its decision in the matter of differential freight rates to and from North Atlantic ports. With the exception of Commissioner Clements, dissenting, the commission was agreed that the differential per hundred pounds on flour all rail and lake and rail should be reduced to 2 cents at Baltimore and 1 cent at Philadelphia, as compared with the rate from what is known as differential territory to New York. It was held that the existing differential on ex-lake grain should be reduced to 3/10 of a cent per bushel, and be allowed both to Baltimore and Philadelphia, and that otherwise the present export differential should remain in force. Upon voluntary submission of the controversy to the commission by all parties, domestic traffic was excluded from consideration.

How long these differentials will be conscientiously lived up to by the lines involved may be a matter of doubt. The arbitration was entered into by the railroads concerned in a spirit of entire fair-mindedness. The differential controversy is about as old as the growth of the ports and their establishment as competitors to one another, and attempt after attempt has been made to determine whether or not the rates on export grain should be the same from the interior to Boston, New York, Baltimore and Philadelphia, and, if not the same, what the difference should be. The current decision does not attempt to lay down any helpful principles in determining this. The commission has taken a large amount of testimony, and presents full statistical tables in its report—which show nothing whatever that is of use in settling the question as to what should constitute the basis of a differential. When Messrs. Thurman, Washburne and Cooley, in 1882, presented their report as an advisory commission to whom the same question had been submitted, they took up each of the suggested principles for determining a differential basis, designating them respectively as the distance principle, the cost principle and the competitive principle. They then showed clearly that no one of these could be applied in such a way that a differential could be established that would be at once scientific and equitable, and they ended by leaving the differentials

just where they happened to be at the time that they undertook the work, and expressed their conviction that the only way to tell what a differential ought to be was to try it, saying that they were not competent to lay down any arbitrary sum which they could recommend in preference to the rates established by practice.

The present report of the Interstate Commerce Commission reviews the whole question over again, taking into its purview both this Thurman, Washburne and Cooley report and the report on the same subject previously made by Albert Fink; but, after reaching the same conclusion, to the effect that there is no basis on which differentials can be made that can be guaranteed to be either scientific or equitable—the commission takes a little off the claim of each competing port and presents a compromise. Commissioner Prouty, in handing down the opinion, says that the first differential of which we have any accurate account, was 10 cents per hundred pounds, but this seems to have been reduced, as early as 1870, to 5 cents per hundred, on grain. The New York lines insisted that even this was too great, and finally, after numerous rate wars, an agreement was made in 1876 that rates to Baltimore, Philadelphia and New York should be established upon the basis of actual distance from the point of origin to the several ports. This agreement continued in effect only six weeks, the New York lines withdrawing at the end of that period upon the ground that the rates so established were unduly favorable to Baltimore and Philadelphia. After a period of rate disturbance the next agreement, signed by the New York Central, the Erie, the Pennsylvania and the Baltimore & Ohio, was dated April 5, 1877, and provided that export rates to Boston should be no higher than those to New York; that rates to Philadelphia should be 2 cents, and to Baltimore 3 cents per hundred pounds lower than to New York upon all classes and commodities. The stated purpose of this agreement was to effect an equalization of the aggregate cost of rail and ocean transportation between all competitive points in the West, Northwest and Southwest, and of domestic or foreign ports reached through the above cities, but in 1880 the New York Central withdrew from the agreement. The differentials next established were those referred to by the Thurman, Washburne and Cooley Commission as existing practice in 1882, and these remained upon the published tariff from 1882 down to 1897 without any formal attempt to alter them, although the rates themselves were not generally maintained and the differentials were not always recognized. In 1897 the New York Produce Exchange filed with the Interstate Commerce Commission a petition against the Baltimore & Ohio and other lines alleging that the effect of these differentials was an undue discrimination against the locality of New York. The conclusion arrived at by the commission was that while the differentials might be unfair as between the different railroads interested, or possibly as between the communities themselves, they were not in principle a violation of the Act to Regulate Commerce, and had not resulted in such an effect upon the movement of traffic as would justify the commission in pronouncing them an undue preference against the port of New York. These eastbound differentials in effect in 1898, when the report in the above case was made, were identical with those of 1882, so far as the published tariff went, but in Februray, 1899, differentials on export grain were reduced one-half. The climax of the situation was reached in the rate war in the early part of 1904, when the rate on wheat from Buffalo to the Atlantic ports for export had fallen to 2 mills per bushel as the result of the differential dispute.

At that time there was very little wheat in Buffalo which could move under these rates, so that the practical effect of the tariff during the winter and early spring was not serious, but as the opening of navigation approached, the commercial organizations of the four cities petitioned the Interstate Commerce Commission to examine the whole subject of differential rates between these points and determine what should be done with the existing differentials. While the matter was under advisement by the commission, the differential in effect at the present time was adopted, providing that all rail export grain and iron and steel articles should take 1½ cents less to Baltimore and 1 cent less to Philadelphia than the New York and Boston rate, and that ex-lake grain received at Buffalo, Fairport or Erie should take 4/10 of a cent. per bushel in favor of Baltimore below the rate to New York, but no differential in favor of Philadelphia. The changes, as compared with the rate which was in effect when the Interstate Commerce Commission undertook to act as arbitrator, are shown in the following table:

DIFFERENTIALS FROM NEW YORK RATE.

	Boston.		Philadelphia.		Baltimore.	
	Old.	New.	Old.	New.	Old.	New.
Export traffic, except iron and grain, per 100 lbs.	+ 7c.*	+ 7c.*	— 2c.	— 2c., except flour	— 3c.	—3c., except flour.
Flour, all rail, and lake and rail, per 100 lbs.	0	0	— 2c.	— 1c.	— 3c.	— 2c.
Iron, steel and grain, all rail, per 100 lbs.	0	0	— 1c.	— 1c.	— 1½c.	— 1½c.
Ex-lake grain, per *bushel*	0	0	0	—3/10c.	—4/10c.	—3/10c.

* + 7c. first class, to 2c. sixth class.

It is pretty well understood nowadays that arbitration means compromise. Had the commission been acting as a rate-making body its action in naming a specific differential at variance with the differential in use, after explaining carefully that there was no basis on which this could be done, would no doubt have been vehemently protested, but its position as an arbitrator by request relieves it from this criticism. Differential controversies always resolve themselves into two kinds of claims that are diametrically opposed; one, that the port which has the greatest aggregate advantages should have the lowest rate because of those advantages, and the other, that the port which has the least natural advantages should have the lowest rate because of this disability. The upshot of the matter is that the export differential is a purely arbitrary device to promote harmony between ports with adverse interests and the railroads serving them. In years when there is an abundance of grain for export, the ports can get along on almost any basis that is not outrageously discriminatory, but in the lean years it never has been possible, and doubtless never will be possible, to please the contending interests.

Commissioner Clements, in his dissenting opinion, speaks shrewdly when he says that whether the carriers see fit to follow the suggestions of the commission, which they are in no sense bound to do, or decline to accede, the commission will in either case be left in an embarrassing attitude. If the carriers refuse, the commission is powerless to enforce its recommendations; yet it is compromised in any subsequent proceeding against finding other rates reasonable. If they acquiesce, the commission will have gone beyond its authority to interfere in the course of trade. "To-morrow," he adds, "we may be called upon to determine what share the Gulf ports may have and the Gulf roads carry, and the next day to fix the proportion to which the Pacific coast is entitled." The commissioner asks, oratorically, if competing carriers may lawfully effect, through the agency of the commission, restraint of competition and trade by a division of traffic between themselves and the ports, when to do the same thing through an agency of their own would be unlawful.

April Accidents.

The condensed record of the principal train accidents which occurred in the United States in the month of April, printed in another column, contains accounts of 16 collisions, 26 derailments, and two other accidents. Those which were most serious, or which are of special interest by reason of their causes or attending circumstances, occurred as follows:

		Killed.	Injured.
2d.	Branchville, S. C.	4	1
20th.	Hattiesburg, Miss.	0	8
22d.	Edson, Wyo.	4	0
29th.	Greenville, S. C.	4	7

To railroad men the most interesting case for study is the Branchville collision. This was investigated by the South Carolina Railroad Commission, and the principal facts brought out by the investigation are given in our account of the collision. In their report on the case the Commissioners say:

> We find the immediate cause of the wreck was that Engineer Reed's watch was 28 minutes slow, he (Engineer Reed) thinking he could make the siding at St. George; but we find that when extra No. 155 left Branchville Engineer Reed and Conductor Stanley seemed to misunderstand as to where they were to take the siding for passenger train No. 15. It appears from the testimony that there was a dense fog, and that the two rear cars were not equipped with air brakes, and this is to be deplored as well as condemned. We condemn the practice of the crews remaining on duty over the required time expressed in the rules governing the working of crews. . . . We must insist upon all railroads doing business in South Carolina, calling in their crews at least after twenty hours' consecutive duty, except on extraordinary occasions. . . . We condemn the practice of the railroad officials in not ordering the dispatchers to state definite places in cases like this for all trains to pass with orders to each crew to that effect.

A 20-hour limit is "easy," certainly. In requiring definite meeting points where irregular freight trains are to meet regular passenger trains the Commissioners will shock the average superintendent and train despatcher, for such a requirement is wildly at variance with the American despatching system; the commissioners will be ridiculed as unpractical meddlers. But nothing is simpler, when once the block system is put in force; and the block system ought to be

everywhere in force, regardless of this particular question.

With the increase in long runs and the more general practice of running at high speed, electric railroads become more like the steam roads in accidents, as well as in other things. One of the collisions included in the total printed below—one which killed one man—was due to forgetfulness on the part of conductor and motorman when a new time-table was issued. A regular meeting point was changed but the men continued to run by habit instead of by time-table.

The total number of electric-car accidents reported in the newspapers in April was 12; killed 4, injured 29.

In answer to a resolution of the Senate directing the Interstate Commerce Commission to report the number of stockholders of each railroad reporting to the commission, a statement has been made public which is the first official compilation of the kind that has ever been printed. The 1,220 roads reporting to the commission had, on June 30, 1904, 327,851 stockholders of record. This figure includes certain duplicates, where the same individual is an investor in the stock of more than one company. Just how large this percentage of error is cannot be accurately stated, but the total figure serves as a rough approximation of the number of persons holding railroad stocks in this country. There are 56 roads on the list which have more than 1,000 shareholders each, although there are several reduplications here, caused by holdings in subsidiary companies. The Pennsylvania heads the list with 44,175 shareholders. The New York Central system is second with 24,941 shareholders, divided among the seven properties covered, the New York Central proper having 11,782 and the Boston & Albany 8,417. The Atchison, Topeka & Santa Fe has 17,823, the Union Pacific 14,256, the New York, New Haven & Hartford 10,842, and the Northern Central 9,123.

The Russians are at last making a beginning with what will be essentially American freight cars, that is, cars of great capacity on four-wheeled trucks. For their long hauls and imperfect tracks, such rolling stock is peculiarly suitable. The new cars are to carry 2,000 poods = 72,225 lbs. The present Russian standard car carries 27,500 lbs. Representatives of six Russian car-works have had a conference with the Minister of Transportation, who then gave out contracts for 2,400 such cars, to be delivered at the rate of 100 per month, beginning with August. For this order, the contractors are permitted to import the pressed steel parts, which will probably come from America.

NEW PUBLICATIONS.

The Graphic Method of Influence Lines for Bridge and Roof Computations. By William H. Burr, C.E., Professor of Civil Engineering in Columbia University, Member of the American Society of Civil Engineers, Member of the Institution of Civil Engineers of Great Britain, and Myron S. Falk, Ph.D., Instructor in Civil Engineering in Columbia University, Junior Member of the American Society of Civil Engineers. New York: John Wiley & Sons, 1905. Octavo, cloth, ix + 253 pages, 3 folding plates, 158 figures in the text. $3.00.

In its arrangement this volume indicates that it is intended to be used by engineering students as a text book. Chapter I., 59 pages, is quite similar to the elementary part of standard works on graphic statics as applied to roof-trusses, excepting that two methods of determining the stresses due to the bending of the supporting columns of a roof-truss under wind pressure are given. The main part of the subject begins in Chapter II., with the definition of influence lines, and examples of the construction of the influence lines for reaction and shear in a simple beam under a single, concentrated, moving load. This is followed by an illustration of the construction of the influence line for reactions under a number of moving, concentrated loads, and is modified so as to show the influence line for maximum shear. In using a uniform load in this form of construction, the uniform load is treated as a series of concentrated loads spaced as closely as the accuracy of the problem demands. The method of constructing the influence line for moments is then given. An illustration of the application of these principles in determining the stresses in a Pratt truss loaded according to class E 40 of Cooper's specifications is given by means of a folding plate. Other forms of trusses are investigated, and the applicability of the influence line is proved by analytical methods.

In the examples given the method by means of influence lines does not appear to have any advantage over the usual analytical method; in fact, the analytical method is probably quicker and has the additional advantage of being more accurate. The claim of the authors that the method "commends itself not only as a simple universal system of analysis, but also as a remarkably labor-saving means of making computations in structural work," will scarcely hold good for bridge trusses; in fact, it will more likely add additional perplexity to a subject already sufficiently difficult for undergraduate students. Thirty-four pages are given to the discussion of the three-hinged arch and cantilevers by the foregoing methods. Chapter V., 16 pages, treats of the method of finding the displacement of any point in a crane and bridge-truss, and in the three-hinged arch by means of the Williot diagram. Chapter VI., 70 pages, treats of the detailed design of the Ten Acre Bridge, designed under the direction of Mr. O. E. Hovey, Engineer of Design, American Bridge Company. The stress sheet and detailed drawings presented by the American Bridge Company are attached as folding plates.

Probably no one way of finding the stresses in different members of a structure is better than another way for all the members. The practical computer will make use of the method that best suits the particular case, but will certainly find it necessary to master the analytical method. The authors, in the preface, state their claims for the universality of the special method of this volume a little too broadly, and in several cases make statements like on page 44: "A more simple solution of this problem is possible by determining the stress in the member L M by taking moments about the peak, and then inserting its value in the force diagram, Fig. 38." The method of influence lines is presented in such manner that those desiring to become acquainted with this method may readily do so. The volume will be valuable for this purpose, particularly as the statement is made in the preface that a second volume will appear which will treat of the application of these lines to statically indeterminate structures, such as two-hinged and fixed ended arches, swing bridges, suspension bridges, and certain types of cantilevers.

TRADE CATALOGUES.

Railroad Paints and Varnishes.—The Sherwin-Williams Company has just issued a new catalogue on paints and varnishes for railroad uses. With the object of making the book as helpful as possible, the different lines of paint have been classified according to the equipment for which each is primarily intended and particularly adapted. There is also a well-arranged table of contents to facilitate reference. A large number of color samples are shown in the catalogue, although they are only a few of the great variety actually furnished. At the back of the book is some general information and some lists. The catalogue is an artistic production. The design and printing, which were done by the Publicity Department of the company, are excellent, and there are a number of colored plates for illustration that add greatly to the appearance and attractiveness of the book. It is 5¾ x 8¾, is put up in board covers with cloth and gold, and contains 87 pages.

The Hall Signal Company, New York, has issued a pamphlet for the International Railway Congress, printed in English and French. In it the company announces the "Hall miniature electric staff instrument," which is described as the latest improvement on the Webb & Thompson electric train staff. The staffs weigh eight ounces each. The Hall Company is prepared to furnish apparatus for taking the staffs on to a locomotive at high speed. The pamphlet is quite brief, giving a few words of history concerning the Hall Company, the pioneer automatic signal company of the world, and a paragraph each on the electric motor, the electro-gas signal, and the enclosed electric disk signal made by the company. The disk signals installed by the Hall Company between Boston and Salem about 1871 are still in operation, and but little changed.

Concrete Block Machines, Tools and General Supplies.—The Hayden Automatic & Equipment Company, New York, sends its illustrated catalogue in which is given a full detailed description of the Hayden automatic concrete block machine. This machine is used for making concrete or cement building block. A full line of solid steel track tools such as chisels, hammers, claw bars, shovels, etc., are also shown.

Cranes.—Pawling & Harnischfeger, crane makers, Milwaukee, Wis., send their 1905 catalogue. It measures 9 in. x 12 in. and contains 140 handsomely illustrated pages. Both light and heavy and standard and special cranes adapted for all purposes are illustrated and described. About 12 pages of the catalogue are devoted to a list of Pawling & Harnischfeger crane users.

CONTRIBUTIONS

Richey's Handbook.

Evanston, Wyo., May 5, 1905.

To the Editor of The Railroad Gazette:

I have just read your review of my book, "A Handbook for Superintendents of Construction, Etc.," (*Railroad Gazette*, April 28) and note what you say regarding error on page 484, which is horse-power $= \frac{\text{watts}}{746}$ or watts = h.p. × 746, and which you claim is contradictory, but I think on looking at it again you will find it correct. The horse-power (electrically) equals any number of watts divided by 746. Thus 7,460 watts equals 10 horse-power, and watts equals the horse-power multiplied by 746, thus, 10 horse-power equal 7,460 watts.

H. G. Richey,
Supt. of Construction, U. S. Public Buildings.

[The statement in Richey's Handbook for Superintendents of Construction, etc., "watts

= h.p. × 746," was owing to the customary use of the symbol h.p. taken to mean, watts = 746 h.p. The explanation in the text, however, should have prevented this misinterpretation. The statement would have been clearer if it had read, watts = horse-power × 746.]—EDITOR.

The Function of the Electric Railway.

Detroit, Mich., May 18, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Referring to your well-considered paper on "Electric Railway Competition," in the issue of May 12: In my judgment, the function of the electric railway as at present developed is simply to pick up passengers at street corners and road crossings for comparatively short rides from one local center to another. They stand in about the same relation to the big roads run by our steam railroad brethren that the corner grocery does to the wholesale establishment. It would not seem to make much difference how the passengers boarding an interstate train or a transcontinental limited get to such trains —whether on foot, in buggies, on horseback, or by trolley car. The local passenger business shown in your statistics as having been lost in certain localities by the steam railroads represents only a very small part of the passenger business gained by electric lines, the truth being that probably as much as nine-tenths of this business is new business, due to the inauguration of this kind of transportation. And I think it probably true also that the general steam railroad passenger business of the country has been greatly benefited and not hurt by it.

I should like to work in full unison with all of the steam railroads with which we come in contact, employing such facilities as we have for handling both passengers and light freight to the best advantage of both, issuing and receiving through bills and through tickets, and otherwise working jointly with them. We are co-operating in that way with various steamship lines on the Great Lakes much to the advantage both to ourselves and to the owners of such lines.

J. C. HUTCHINS,
President, Detroit United Railway.

Car Wheel Tests.

Pittsburg, Pa., May 22, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In the communication published in the *Railroad Gazette* of May 19, Mr. P. H. Griffin presents some interesting figures showing the results obtained with the use of chilled iron car wheels under 100,000-lb. cars. It is said that the price paid for these wheels permitted the use of good material and practice, from which it can be inferred that they are of a quality to be well recommended by the distinguished manufacturer. In the first case quoted of these special wheels, the removals claimed under guarantee are at the rate of 1 per cent. per annum, and in the second case the removals from all causes at the rate approximately of 7 per cent. per annum. Whether these percentage figures afford agreeable comparisons with wheels of less weight can be answered by various motive power men.

Mr. Griffin states that a thermal test does not represent service conditions. In this statement he apparently loses sight of the "factor of safety," which is a highly desirable feature of any test with respect to the later service to which the material may be subjected. In other words, it is incorrect to assume that the quality test of an article should be such as to equal, but not exceed, the exact demands of service. To insure endurance and safety a test should be more severe than the actual service required, and this is the object aimed for in providing the thermal test.

I will admit that ordinarily in such a test the heating extends, but a "short distance into the single plate during the period the test is in force"; but I will not admit that even this effect is insufficient to frequently cause the wheel to crack, indicating weakness of quality or perhaps design. If Mr. Griffin refers to two minutes as the length of time the test is in force, then the effect is not particularly hazardous, but if the hot ring is left on the wheel for a greater time the effect more closely represents service condition and cracks more frequently appear in the brackets and at various points of the plate or plates. Of 104 successive thermal tests made on standard 600-lb. M. C. B. wheels, on which the hot band remained for five minutes, it was observed that 16 per cent. of the test wheels were cracked in some place at the expiration of the time. But of 224 successive tests including the above, only two failed by breaking through the tread in two minutes although several cracked in other places in less time.

It must be remembered that the thermal test does not necessarily indicate, although it may cause the cracks in flanges which Mr. Muhlfeld has alluded to as a serious result of braking on cars of large capacity. Presumably, 47 wheels were removed from such primary cause from the 400 special P. R. R. wheels mentioned. This is the largest percentage removed from any one cause; and while it is impossible to say, it is certainly reasonable to suppose that subjecting the wheels to a thermal test imposing more severe conditions would materially have reduced this percentage. Mr. Griffin's statement that the temperature of the tread rises 500 or 600 deg. in a few seconds during the thermal test seems somewhat exaggerated. I have observed many wheels which after two minutes of contact with the hot band can be easily handled by one's hand protected only by a piece of leather. But admitting his statement, the strains of expansion and contraction that are produced by the thermal test certainly resemble the effects of brake heating; and, particularly as the length of the test is extended, this effect is emphasized by causing the wheel to crack probably near the junction of the single and double plates.

The writer believes that the specification clause relating to the thermal test is a very weak one, and as the test is often made in a desultory manner without regard for the real intent, it becomes of little importance except as a means for indicating an extremely bad quality. Assuming a correct design for the wheels to allow for strength to resist expansion and contraction, it is believed that the ordinary defects of wheels in service caused by braking could be lessened by prescribing conditions for the test which would:

1. Govern the length of time in which the molten iron must be poured to form the ring.
2. Increase the interval of time in which the wheel must not break in two pieces, and providing, particularly, different intervals for wheels of different weight.
3. Provide for the cracking of plates or brackets in a certain interval of time.

C. W. GENNET, JR.

Proposed Alliance of "Tech" with Harvard.

Boston, Mass., May 13, 1905.

TO THE EDITOR OF THE RAILROAD GAZETTE:

There is such widespread misunderstanding of the attitude of the faculty and former students of the Massachusetts Institute of Technology towards the proposed alliance with Harvard, that the public should be definitely informed, in as few words as possible, of the real grounds of the opposition of at least 90 per cent. of the men of those two bodies. College loyalty and sentiment, very properly, play a part in determining their attitude towards the suggested partnership, but it is a very minor one; the chief grounds of opposition are to be found in that common-sense, clear thinking and business caution which the institute training does so much to foster. The theoretical advantages of such an alliance are indeed attractive; but when reduced to the practical details of a definite plan, based upon the actual conditions to be met, the objects desired can be but partially realized, if at all, and serious complications arise which make the experiment dangerous and unwarranted.

Four main arguments are used in urging institute men to ratify this proposed alliance; (1) that it will bring in money; (2) that it will save money; (3) that it will broaden the institute education; and (4) that it will promote the cause of higher education. Even were all these advantages to be secured, theoretically, through an alliance with Harvard, the faculty and former students of the institute object, by an overwhelming majority, to the practical means proposed. By this "proposed agreement" Technology is called upon to sign a contract vague and unbusinesslike in form, revocable at the will of either party, wholly contingent upon legal interpretations and decisions, pregnant with misunderstandings, and requiring the institute to assume most of the present burdens and, in case of rupture, all future losses. The plea that this is a "gentlemen's agreement" does not reassure men accustomed, as are those of the institute, to reading contracts and weighing their probable results. Long experience has taught them that such documents must sooner or later face the courts and that the law reads them as they are written, not as "gentlemen" may be willing to interpret them.

This "agreement," moreover, requires the institute to bury all her present resources in real estate near enough to Cambridge to share the disadvantages of that locality, but not near enough to partake of the real advantages of the collegiate environment; forces her to agree to reimburse the university in the event of annulment of the contract; and compels her to reorganize her government, to limit her choice of an executive board, and radically to change the policy which has given her the prestige she now holds—a prestige which has been attained, moreover, only because of her unique position as an independent institution.

Setting aside the question of the moral rights of the university, even though she may secure legal permission, to divert bequests from their intended purposes, and assuming that the Supreme Court decides that a part of the McKay money may legally be spent at the institute, even then this highly objectionable "agreement" does not achieve what it is supposed to accomplish. Were it to be ratified, the institute, for a generation to come, would secure from Harvard only money enough to pay the cost of teaching the Lawrence Scientific School students and would be compelled to bear the whole burden of providing for the natural expansion of the combined institution. The McKay Endowment, under this plan of alliance, would yield to the institute only three-fifths of the income of the net income of the estate for about 50 years, and the sum then available would be only three-fifths of the income of the accumulation of about $5,000,000. To offset this, however, the institute would lose at least $2,000,000 dollars in bequests contingent upon her independence, would undoubtedly forfeit state support, and, most serious of all, would almost wholly cut off the present and future financial support (direct and indirect) of the more than six thousand former students who are now enthusiastically ready to assist her.

The plan of alliance will not save money for the institute because it does not and—except by giving a cheaper and less thorough education—cannot avoid duplication in either instruction or equipment. To save money in administration (following the example of business mergers) is possible, but only on condition of making the institute an integral part of Harvard University.

The plan will not really broaden the educational life of the institute; it will merely substitute for the well recognized and thoroughly tested spirit of technology the different spirit of the university. The students of the institute, already pressed with the necessary work of their own courses, could find no time for intercourse with those of Harvard even were they to be admitted (as Dr. Pritchett says they are not) to the undergraduate classes of the university. The association of Harvard and Institute professors upon one faculty is likely to lead to friction rather than to educational development, since the Harvard members to be

injected are mainly heads of established courses. As to the broadening which is supposed to come from paying larger salaries to teachers, that cannot take place for at least 50 years, since neither the "proposed agreement" nor the McKay Endowment (until the death of the last annuitant) can provide higher salaries.

The projected alliance, finally, will injure, not help, the cause of higher education: (1) because it does away with competition, that leading stimulus to educational development; (2) because it creates a school too large for the only right kind of higher education—that which places every student under the immediate supervision of one or more members of the faculty; (3) because it restricts the choice of youth seeking a higher technological education to one kind of institution in this educational center; and (4) because it brings to an end the great endeavor of Rogers, Runkle, Walker and their associates to build up, on a basis of science, modern languages, history and economics, a true university which shall meet modern conditions and needs more fully than can any of the older colleges.

M. I. T. ALUMNUS.

Railroad Telegraph Superintendents.

The 24th annual meeting of the Association of Railway Telegraph Superintendents was held at Chattanooga, Tenn., on May 17 and 18, President H. C. Hope, of St. Paul, presiding. The report of the treasurer showed the affairs of the association to be in an excellent condition.

After the disposition of some routine business Mr. Frank T. Fowle, of the American Telephone & Telegraph Co., read a paper on the Railway Telephone Service and Cost of Line Construction.

A report of this paper must be deferred to a future issue.

Mr. Fowle's paper was discussed by L. B. Foley (D., L. & W.), W. J. Camp (Canadian Pacific), P. W. Drew (Wisconsin Central), E. A. Chenery (Missouri Pacific), E. E. Torrey (Mobile & Ohio), E. P. Griffith (Erie), Percy Hewitt (Southern Pacific), H. J. Hope (C., St. P., M. & O.), G. C. Kinsman (Wabash), and others. At the conclusion of the discussion the convention adjourned and the members visited Lookout Mountain. In the evening they attended an open air vaudeville entertainment.

Denver, Colo., was selected as the next place of meeting, and the time was fixed for June 20, 1906.

Mr. W. J. Camp (C. P. R.) read a paper on "High Tension Wires on Railway Right of Way." Installations are being made at various points all over the continent for general electrical power and transmitting it long distances; the voltage on the transmission wires varying from 10,000 to 70,000 volts. Applications have been made to the different railroad companies for the privilege of carrying the transmission line along the railroad right-of-way, and it is altogether likely that the number of these applications will increase. The telegraph department of the Canadian Pacific has generally opposed granting permission for various reasons, such as danger to life and property, and induction on telephone lines. Up to the present time the working of the Canadian Pacific telegraph wires has not been affected, although there are several power lines paralleling the line. In British Columbia, 20,000 volts from Nelson to the power house 16 miles; from the power house to Rossland, 55 miles, two power wires parallel the railway for 20 miles, then diverge for some distance when they again parallel for 15 miles. The distance from the telegraph wires varies from 30 ft. to 200 ft. On other sections in Eastern Canada power lines are on the right-of-way, in one case, for ten miles, but on the opposite side of the track from telegraph line.

The Great Northwestern Telegraph Company has suffered somewhat from induction on a line between Chambly and St. Lambert, 20 miles, and between Shawinigan and Montreal, 95 miles. No ill effects were experienced on the telegraph wires until they were transferred to the present route from Joliette to Montreal (new piece of railway) but since then it has been found very difficult to keep adjusted on account of a continual hum from the power circuit. The voltage of the power circuit is about 50,000.

In the matter of wires crossing a railroad the Canadian Railway Commission has power to forbid wires—for telegraph, telephone, or for the conveyance of light, heat, power or electricity. We have one crossing in British Columbia, where the power wires are 400 ft. above the track; parallel with the track on each side, a heavy iron rod is supported on poles and grounded. If a wire breaks it will not be low enough to touch anything. Generally this plan is impracticable. The use of a screen under the power wires is the method most in use, but there are many objections to it.

On motion of E. P. Griffith (Erie) a committee consisting of E. P. Griffith and L. B. Foley, of New York, and C. P. Adams, of the Southern Railway, Washington, D. C., was appointed to bring this matter to the attention of the American Railway Association with the object of having that body request all state legislatures to enact laws for the protection of the railroads from the erection of wires over their rights-of-way.

William Maver, Jr., of New York, read a paper on "Overhead Breaks and Their Remedies." A committee of five was appointed to see if remedies could not be suggested to overcome the disastrous breaks in telegraph construction work during snow and sleet storms. The committee consists of Wm. Maver, Jr., C. H. Bristol, F. F. Fowle, L. B. Foley and G. C. Kinsman.

Mr. Charles Selden (B. & O.) from the committee on telephonic train orders reported progress, and the committee was instructed to further investigate the subject and report at the next convention. This committee consists of Charles Selden, E. P. Griffith, and J. S. Stevens.

The election of officers resulted as follows: E. E. Torrey (Mobile & Ohio), Jackson, Tenn., President; E. A. Chenery (Missouri Pacific), St. Louis, Mo., Vice-President, and P. W. Drew (Wisconsin Central), Milwaukee, Wis., Secretary. This is the 23d time that Mr. Drew has been selected to fill the position of Secretary and Treasurer.

The deliberations of the convention then proceeded under the direction of the new President, Mr. Torrey. The report of the committee on "Typewriters in the Railroad Train Service" was asked for, but W. F. Williams, of Portsmouth, Va., chairman of the committee, said that as the recommendations of the association on this subject had been adopted by the American Railway Association, there was nothing further for his committee to do. The committee was thereupon discharged.

On Friday about 50 of the members and their friends visited the battlefields and the National Park at Chickamauga.

EXHIBITORS.

Selective telegraph instruments by the Morse Code Signal Company, of Milwaukee, Wis.

The United Electrical Manufacturing Company, of 53 Vesey street, New York, Autoplex dry batteries.

The Martin Vibroplex transmitter.

The Stromberg-Carlson Telephone Manufacturing Co., of Rochester, N. Y., and Chicago, represented by R. B. Tyler; telephonic apparatus and other devices made by the concern for railroad telegraph service.

W. S. Logue, of the Edison Manufacturing Company, New York; batteries.

Mr. A. P. Eckert, Safety Insulated Wire & Cable Company, New York.

Railroad Supply Company, Chicago, E. W. Vogel. —This company's signals are in use on a very large number of railroads. The company makes the American Crossing Alarm; The Ross & Holden Crossing Signal, The O'Neil Highway Alarm, and others.

The Cost of Locomotive Operation.

VI.

BY G. R. HENDERSON.

(*Continued from page 388.*)

WATER.

While water is a comparatively low priced article, and according to railroad statements generally, plays an unimportant part in the expense of operation, it is actually responsible for a great deal more in operating charges than it is usually credited with. The trouble is, in some respects, like that stated in the last chapter regarding coal, that a great deal of material is supplied with water that is not water. In coal, this ordinarily means that we lose a quantity of heat represented by the weight of the non-combustible elements present, but with water it is much more serious, since besides interfering with the operation of the engine, the objectionable matter may quickly cause the destruction of the boiler itself, the most important part of the locomotive.

QUALITY.

As with fuel, the different kinds of water are numberless, and on most roads no two supplies will be alike. This may or may not be an advantage, depending upon the contents of the several waters of a division, and the method of operating the locomotives. An absolutely pure (distilled) water would probably not be desirable, as its action on the metal of the boiler would be quite rapid. On a railroad in Virginia, the waters at the east end are impregnated with tannic acid, which is quite corrosive by itself, but when mixed with the scaling waters farther west, as occurs with locomotives that run through, the effect of one neutralizes the other, producing good results.

To give an idea of the variation in quality of waters, it is stated that there are but two grains of solid matter to the gallon in that of Loch Katrine, Scotland, whereas the water of Great Salt Lake, Utah, contains 22,000 grains per gallon, sea-water averaging about one-tenth of that amount. The quantity that may be tolerated in water for locomotive purposes depends entirely upon the constituents, some being much more deleterious than others. Unfortunately, even more so than with coal, water must be largely used as it is found, that is, a railroad in running through a country, must ordinarily use such water as can be obtained convenient to the track. This is often overlooked in locating water tanks and pumphouses, the fact that there is *plenty of water* appealing to those in charge of the work, when by some additional trouble and expense, a better water may be obtained. Of course, quantity is of the *first importance*, but it is too often the *only consideration*.

In a general way we may form five classifications of boiler waters, as follows:

1. *Practically Pure.*—This includes waters that have little or no scale forming matter, corroding ingredients, or soluble salts to cause foaming. They may contain sewage or other matters that would render them unfit for drinking purposes, yet would not be detrimental to the boiler. While, for instance, the water of the Chicago river is totally unfit for house use, it is quite satisfactory for steam making purposes. Many natural lakes and rivers contain practically pure water, and the result is immunity from boiler troubles. One of the lines operating between New York City and Buffalo has water so pure that fire-boxes have been known to last for 20 years, while the average

for the United States is perhaps about five years. It is hard to fully appreciate the great benefits which result from the use of good water, and it is worth much expense and trouble to obtain it.

2. *Forming Soft Scale.*—This is the common attribute of waters which contain carbonates of lime and magnesia in solution. When such water is boiled, the carbonic acid in the water (which is necessarily present to account for the solution of the carbonates, as they will not dissolve in pure water), is driven off by the heat, and the salts are deposited on the inside of the boiler. These deposits are not hard, but bulky, and as they are poor conductors of heat, they reduce the efficiency of the boiler until they are removed by washing out with a strong stream of water. This causes delay and additional expense.

3. *Forming Hard Scale.*—This is a characteristic feature of water containing sulphate of lime or magnesia, which forms a very hard scale on the water surfaces of the boiler—sometimes as hard as porcelain. It is not precipitated until the temperature of the water is about 300 deg. Fahrenheit; it is a poor heat conductor, and is very hard to remove. When a thick deposit is present, there is a tendency for the parts to become overheated, and leaks, cracks and similar troubles are constant. It is frequently necessary to wash out the boilers every trip, where sulphate waters are in use.

4. *Corroding.*—When water drained from mines is used, there is generally a quantity of sulphuric acid present, which actively attacks the steel of the boiler, and pitting and eating away of the sheets and tubes results. Carbonic acid in solution, chloride of lime or magnesia produce similar results, and these effects are the most dangerous of the several troubles caused by impure water. Constant washing out and inspection are necessary, involving time and expense, and boiler repairs are frequent and elaborate. Such water should be avoided, if possible.

5. *Foaming.*—This is, perhaps, the most troublesome, from an operating standpoint, of all the burdens that attend the use of impure water. Broken cylinder heads, pistons, rings and valves, blowing packing on piston rods and valve stems, cutting valves and seats, and often the complete destruction of the fire-box itself result from foaming water. It is necessary to carry a very low level in the boiler—sometimes below the bottom of the gage glass, and this is often responsible for dropped crown sheets and ruined locomotives. It is practically impossible to remedy, except by distillation, as the salts, generally sulphate of soda and chloride of sodium or calcium, cannot be removed by precipitation. Distillation will remove them, but if fuel is high it may be an expensive process. However, the matter is so important that it is worth much more attention than is generally given to it. If there are over 50 grains of soluble salts to the gallon, trouble is sure to follow, and the cost of such consequent damage will often equal the additional expense for providing good water.

PRICE.

While ordinarily the price of water is low, there is a great variation in this item. If the railroad company owns a good spring near the track, so that it can run water by gravity to the tank, the cost will be practically nothing; if, however, it must be purchased from a city or water company, the price may be anywhere from 3 to 20 cents per thousand gallons; if the water has to be hauled, it may cost from 20 to 50 cents a thousand gallons, and even then it may be a continual source of expense.

The first cost often receives too much and the after result too little attention. This can be illustrated by a case that occurred in the State of Iowa. The city at the point in question asked a rate for water which the company thought was too high, so their engineers drove a 70-ft. well, from which water was obtained *apparently* at lower cost. There is no question but that the water cost *less in the tender*, if not after it passed *through the boiler*. The relative values of the two waters, however, are apparent if we compare their analyses:

Grains per Gallon of Water.

	City supply.	Railroad well.
Carbonate of lime.....	4.74	24.39
Carbonate of magnesia..	1.41	1.18
Sulphate of lime	.78	6.22
Sulphate of magnesia ..	.54	13.33
Alkali chlorides	.67	1.21
Alkali sulphates	2.97	5.58

The city water was a comparatively good one—the company well caused trouble by scaling, both hard and soft, and so great was the annoyance that it was finally considered preferable to use the city water at the increased figure, and prevent the continual washing out and leaking of the engines.

Many roads now make it a rule to establish no new water stations, until the supply has been sampled and examined by the chemist, and this practice cannot be too well commended, as much trouble and expense may be saved later on.

As there may be much time and money expended upon the water after its purchase or in curing its evils, we must consider these in their turn.

PUMPING.

The cost of pumping water depends upon the quantity handled, the height and distance through which it is transported, and the cost of the fuel and attendance. A gravity supply will need no power or attendance, and will cost nothing for placing in the tanks. At the Detroit meeting in 1899 of the Association of Railway Superintendents of Bridges and Buildings, it was stated that from reports submitted by different railroads the cost was apparently 5.5 cents per thousand gallons when pumps were operated by steam, and 1.5 cents for gasolene engine pumps. As a comparison, it was further suggested that water could be pumped as cheaply with coal delivered at the pump-house for 60 cents a ton as with gasolene at 10 cents a gallon. Considering the cost of fuel only the smaller amount of labor usually needed for a gasolene pump is also in its favor.

It is evident that much depends upon the size of the plant. Small steam pumps may use as much as 15 or 20 lbs. of coal per horse-power hour while gasolene engines take about one-tenth gallon of fuel. At this rate, with coal at $1.50 a ton and gasolene at 10 cents a gallon, the fuel costs would equal each other. The actual cost must include labor and repairs as well as fuel.

The Chicago & Alton has gone very extensively into the use of gasolene pumping engines, and a remarkable reduction in cost has followed. From a circular issued by the Otto Gas Engine Works we find as follows:

Cost of Pumping Water per 1,000 Gallons.

Place.	Steam.	Gasolene.
Joliet, ...	6.14 cts.	3.01 cts.
Pontiac	9.40 "	2.74 "
Mexico.	4.05 "	2.82 "

The saving for the line averaged between two and three cents a thousand gallons for November, 1903, when about 60 per cent. of the steam plants had been replaced with gasolene engines, against November, 1900, when there were only two such stations. In examining the table, given by the Otto Gas Engine Co., it is evident that the saving is mostly in the reduction of labor, as the cost of supplies are higher now than previously. This is not to be wondered at when we remember that the C. & A. runs directly through a coal country, and should be able to obtain very cheap fuel.

Where the wells are deep the "air lift" process is often adopted. This requires an air compressor, which may be driven by any source of power or kind of fuel; the labor or attendance would be considerable in any case, as the compressor would have to be watched. In a plant having a capacity of 1,500,000 gallons in 20 hours, and a total lift of 75 ft., with coal at $2.00 per ton, the estimated cost is 1.1 cents per 1,000 gallons, and this includes an allowance for depreciation and interest on the investment.

It naturally follows that each point must be considered by itself and in connection with the existing conditions and the cost of fuel and labor. Perhaps 5 cents a thousand gallons for pumping alone would be a high average cost, but if the water itself does not have to be paid for, and is not delivered under pressure, this would probably be a fair figure upon which to base cost in the supply tank.

(To be continued.)

Railroad Decisions in April.

The following cases summarize important railroad decisions in the United States Supreme Court and the other Federal Courts during the past month:

Franchise Taxes.—The Federal constitution does not forbid state taxation of the franchise of a domestic railroad corporation at a different rate from that assessed upon other tangible property of the state, and Federal courts are without power to enjoin the collection of such taxes. Coulter vs. Louisville & Nashville Railroad Co. (U. S. Sup.), 25 Sup. Ct., 343.

Service of Process on Officer of Non-resident Railroad.—The mere ownership of lands within a state by a railroad company none of whose offices is located in the state or territory does not authorize service of summons on the president of such railroad while passing through the state on a railroad train. New Mexico vs. Baker (U. S. Sup.), 25 Sup. Ct., Rep. 375.

Preferential Claims on Funds in Hands of Receiver.—A claim for ties necessary to the preservation of a railroad, furnished within six months of the appointment of a receiver, is not, in the absence of special circumstances other than the receiver's use of such ties on hand at the time of his appointment in the maintenance of the road as a going concern, entitled to a preference over a lien expressly created by a mortgage of the railroad property recorded before the tie contract was entered into. Gregg vs. Metropolitan Trust Co. (U. S. Sup.), 25 Sup. Ct., Rep. 415.

Loss of Goods by Fire.—In an action for damages to goods stored on a dock caused by fire it may be shown, on the question of sufficiency of the watch to discover fire, that the watch employed was an habitual drunkard, and on the question of the number of watchmen required the company may show the existence of labor troubles rendering the employment of such men difficult. Texas & Pacific Railway Co. vs. Coutourie, 135 Fed. Rep. 465.

Injury to Persons on Track.—A person walking beside a track who steps on the track to cross a cattle guard is guilty of contributory negligence preventing a recovery where the train causing the injury could have been seen for 300 yards, notwithstanding the injured person testified that she looked and listened before stepping on the track, where it was clearly shown that the train was in plain sight at the time. St.

Louis Southwestern Railway Co. vs. Purcell, 135 Fed. Rep. 499.

Automatic Car Couplers.—The Federal statute requiring common carriers engaged in interstate commerce to use automatic car couplers and air-brakes on engines and cars used in interstate commerce has no bearing in an action for injuries to a fireman by a collision in a railroad yard where there was no proof that the engine and cars in collision were used in interstate commerce.

Yard Rules.—A rule that yard limits at certain points were designated by signs and that it would not be necessary for any engine or trains occupying the main track inside of the yard limits to be protected by flagmen, except when in the time of a first-class train was explicit enough and sufficient to protect a train on the main track within the yard limits of one of the places so designated against collision with a switching train in the yard. Rosney vs. Erie R. R. Co., 135 Fed. Rep. 311.

Conductor and Engineer Not Fellow Servants of Brakemen.—Under the Mississippi statute abrogating the fellow servant doctrine in relation to railroad employees a brakeman acting under the orders of a conductor in making a coupling may recover for injuries received by reason of the engineer backing the train suddenly and without warning while engaged in the performance of this duty. Moore vs. Illinois Central Railroad Co., 135 Fed. Rep. 67.

Diversions of Shipments.—Where the contract for through shipment did not specify the lines over which the shipment should be made it was not negligence for an intermediate carrier to divert the shipment to a different line from that routed by the initial carrier; a delivery to the next connecting being impossible by reason of floods and no danger reasonably to be anticipated from the diversion. Empire Cattle Co. vs. Atchison, Topeka & Santa Fe Ry. Co., 135 Fed. Rep. 135.

Leased Lines.—Under the laws of Missouri a domestic corporation which has leased its road to a foreign corporation is liable for injuries inflicted by the lessee in the operation of the road. Keller vs. Kansas City, St. Louis & Chicago R. R. Co., 135 Fed. Rep. 202.

Fixing Rates by Interstate Commerce Commission.—An order of the Interstate Commerce Commission based on a finding that the action of railroads changing their classification by advancing hay and straw in carloads from the sixth to the fifth class was unlawful, and commanding them to desist from the practice and restore the former rates is invalid as an attempt to fix rates and beyond the power of the commission. Interstate Commerce Commission vs. Lake Shore & Michigan Southern Ry. Co., 134 Fed. Rep. 942.

Railroad Bridges Over Navigable Streams.—A railroad company which has built a bridge across a navigable stream under congressional sanction has a vested right to maintain the same so long as it is used for railroad purposes and cannot be deprived of this right by the courts on the ground that the bridge is an obstruction of navigation. That can be only done by Congress and on payment of just compensation. United States vs. Parkersburg Branch Railroad Co., 134 Fed. Rep. 969.

Injuries to Express Messengers.—A railroad company may lawfully exempt itself by contract with an express company using its cars from liability for negligence causing injuries to express messengers occupying such cars, and where the messenger has consented to this exemption in his contract of employment he may not recover from the railroad company for such injuries. Kelley vs. Malott, 135 Fed. Rep. 74.

Automatic Couplers.—The Federal Act requiring automatic couplers forbids the use of cars which cannot be coupled automatically by impact and uncoupled without the necessity of men going between the cars, and where cars are defectively equipped in this respect it is not a defence that reasonable care and diligence was exercised in keeping the car in repair. It is regarded as a deliberate defiance of the law to forward such a car with a "M. C. B." defect card attached noting defect. The car is regarded as engaged in interstate commerce where loaded with a consignment for another state, though the railroad charged with violating the law only undertakes to deliver the car to a connecting carrier within the state. United States vs. Southern Railway Co., 135 Fed. Rep. 122.

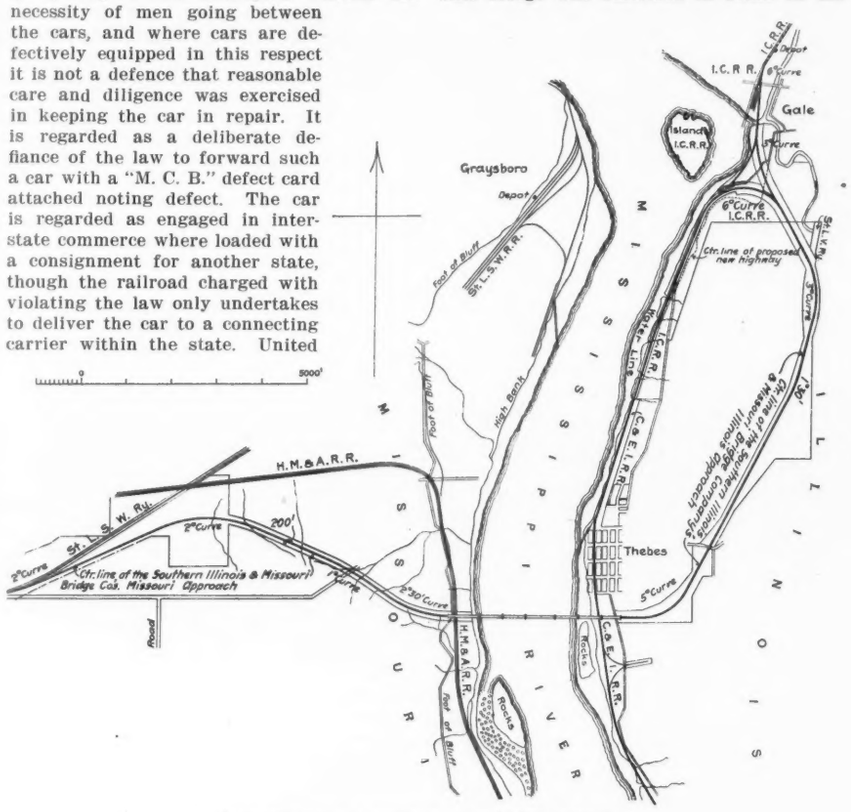
Act of God as Defence.—A carrier will not be liable for loss through an act of God which could not reasonably have been foreseen, although but for its previous negligence in delaying transportation the property could have escaped danger. Empire Cattle Co. vs. Atchison, Topeka & Santa Fe Ry. Co., 135 Fed. Rep. 135.

Railroad Accounting.

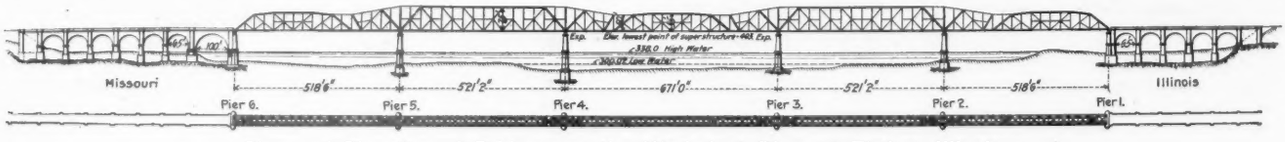
The paper prepared by Mr. A. H. Plant for the International Railway Congress on this subject was noticed in the *Railroad Gazette* of May 5 and May 12. The discussion of the subject by the Section resulted in the adoption, by the Congress, of a series of conclusions which were drawn up by Mr. Plant and Mr. von Lohr, the latter being the writer of a paper on the subject for countries other than America. The two salient conclusions were (a) experiments with simplified processes should be earnestly continued, and (b) the most extensive possible use should be made of labor-saving appliances, such as typewriters and calculating machines.

The Mississippi River Bridge at Thebes.

The large cantilever bridge of the Southern Illinois & Missouri Bridge Company across the Mississippi river at Thebes, Ill., begun in January, 1902, has been completed. This bridge was described in detail in the *Railroad Gazette* two years ago (Jan. 9, 1903) and liberal extracts are made below from that article in order that the accompanying series of photographic views will be the better appreciated. The map and the general plan and elevation of the bridge are also reproduced from that article.



Map Showing Location of Thebes Bridge.



Plan and Elevation of Bridge over the Mississippi River at Thebes, Illinois.

The east approach to the bridge consists of the east abutment, five arches of 65 ft. clear span, and four supporting piers; the west end of the west arch is carried on a buttress forming part of the bridge pier. The west approach, beginning with the west end, is similar to the east approach, there being the same number of 65-ft. arches. But there is an additional arch of 100 ft. span at the east end of this approach adjoining the bridge proper. Regarding this feature it is of interest to know that the original design as submitted to the War Department for approval showed all river piers placed 150 ft. west of their present position, and all approach arches were of equal span, making the entire structure very symmetrical. The commission of government engineers appointed by the War Department to examine

Fig. 1—The Illinois Portal of the Thebes Bridge.

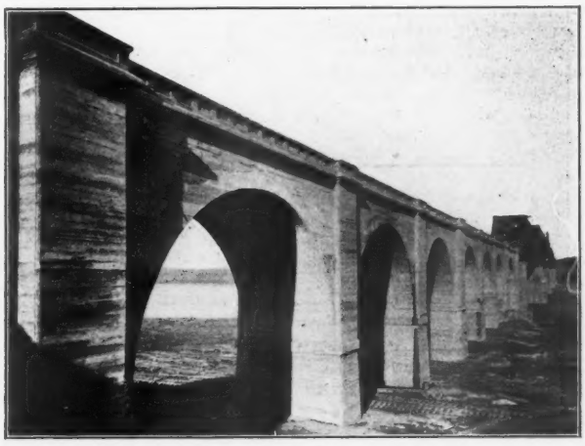


Fig. 2—Concrete Arch Approach, Missouri Side.

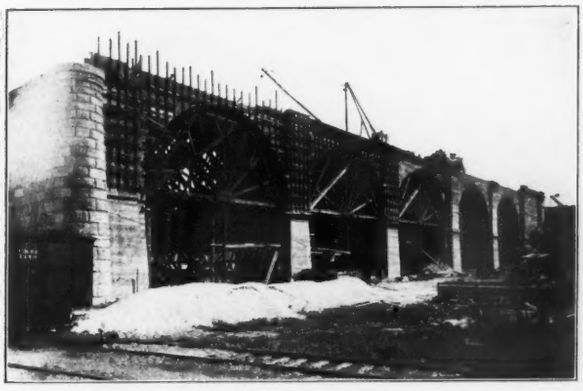


Fig. 3—Illinois Approach, Partly Completed.

Fig. 4—100 ft. Arch Centering, Missouri Approach.

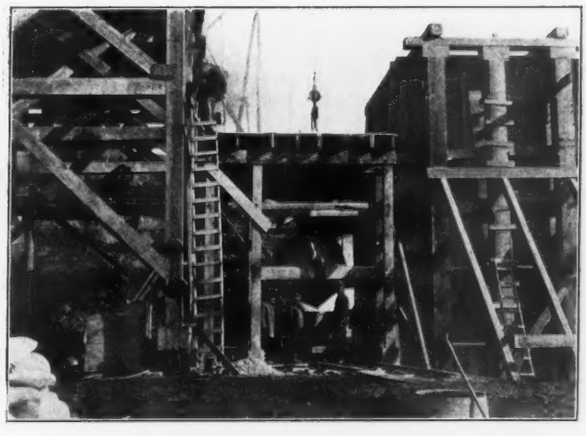


Fig. 5—Cubical Concrete Mixer.

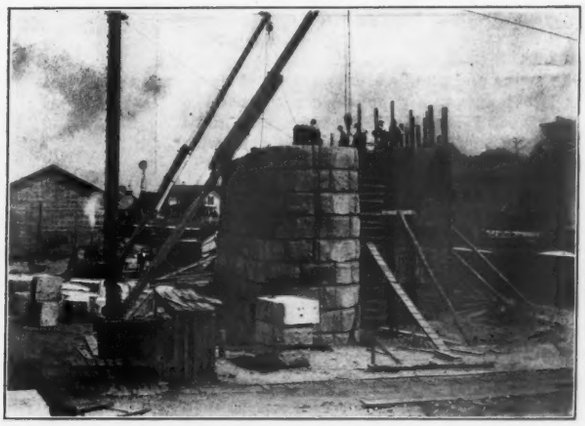


Fig. 6—Pier 1 and Adjoining Concrete Buttress During Construction.

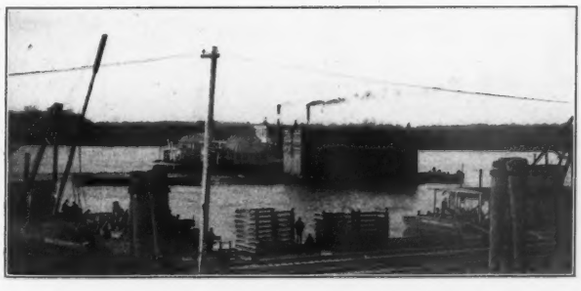


Fig. 7—Caisson for Pier 3 Ready for Launching.

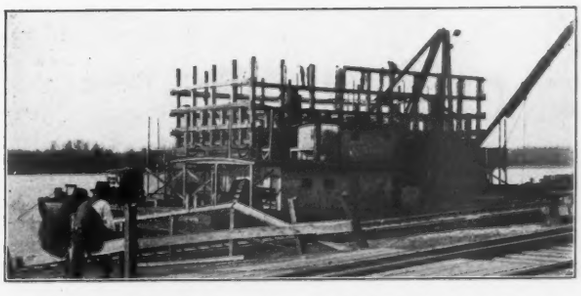


Fig. 8—Interior Framing of Caisson for Pier 3.

Fig. 9—Caisson for Pier 1, Partly Sunk.

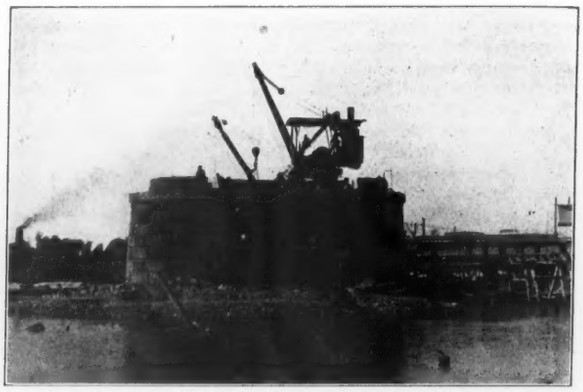


Fig. 10—Laying Masonry of River Piers with Locomotive Crane.

the bridge site decided after consultation with pilots representing the river navigation interests that the main channel should be moved 150 ft. west. In consequence of this it became necessary to provide sufficient waterway just west of pier 6, which is accomplished by the 100-ft. span concrete arch.

The superstructure is carried upon six piers, the first and last of which, as already mentioned, support the ends of the adjoining arches of the respective approaches. The piers are founded on bed rock, all by means of pneumatic caissons except No. 6, which was founded in open excavation. All main piers above the caissons were built of masonry backed with Portland cement concrete; but piers 1 and 6 have the buttresses supporting the adjacent viaduct arches built wholly of concrete.

The superstructure is composed of two fixed spans, four cantilever arms and three suspended spans, as follows: The central, or channel span, which is 671 ft. long, is made up of a suspended span 366 ft. center to center of end pins. On each side of the channel span is a fixed span 521 ft. 2 in. long. And lastly the shore spans, consisting each of a cantilever arm and a suspended span of the lengths given above.

The spans and panels are so arranged that only two lengths of panels are used, namely, 32 ft. 6⅞ in. in the two fixed spans, and 30 ft. 6 in. in the center span and the two shore spans. It will be seen that this arrangement makes all three suspended spans alike; also all four cantilever arms and both fixed spans alike, reducing the variety of component parts to the minimum. The total length of the bridge proper is 2,750 ft. 4 in., and of the entire structure, including earthwork and masonry approaches, 3,907 ft.

It is a double-track bridge with 28 ft. clearance between trusses. The height of the fixed spans is 75 ft., of the suspended spans 55 ft., and of the cantilever arms 50 ft. at the ends. The height of the bottom chord is 65 ft. above high water and 103 ft. above low water, which is zero on the U. S.

Fig. 11—Unloading Superstructure Material at Pier 4.

gage at Gray's Point. The distance between trusses is 32 ft. center to center. This was made as small as was possible to still allow 28 ft. clearance. In order to do this very close packing had to be resorted to at the various intersecting points of truss members. The compression chords, as well as those subject to reversal of stress, are all built with four webs and eight angles. The top chords are 42 in. deep in the fixed spans, and the bottom chords are 36 in. deep. The main pins in the trusses are generally 14 in. in diameter, while the main bearing pins under the ends of the fixed spans are 18 in. in diameter. All pins of large diameter are bored through the center.

The largest eyebars are 14 in. x 2½ in. In order not to exceed the weight of 4,800 lbs. for one bar, it was necessary in one case to subdivide the diagonals by placing an intermediate pin half way between the connecting point of the top chord and the middle of the height of the truss. In another case three bars 14 in. x 1⅜ in. are riveted together for the same purpose. This limiting weight of 4,800 lbs. was imposed by the manufacturers and seems to be the limit which cannot now be conveniently exceeded without excessive difficulties in manufacture. All lateral and sway bracing is stiff, built of angles riveted to lateral plates, which in their turn are riveted to the top chords. In spans of this length the lateral vibration is liable to be excessive, as is demonstrated on existing cantilever bridges. It is expected that this stiff bracing will reduce this vibration considerably.

Fig. 3 of the accompanying half-tone illustration shows the east concrete approach partly completed, the forms being seen and the centering in place for three arches; also pier 1 completed. Three sets of centering for 65-ft. arches were made and were used for all of the approach spans of that dimension. The centering for the 100-ft. arch, which is shown in Fig. 4, is different from the 65-ft. centering, the reason being that

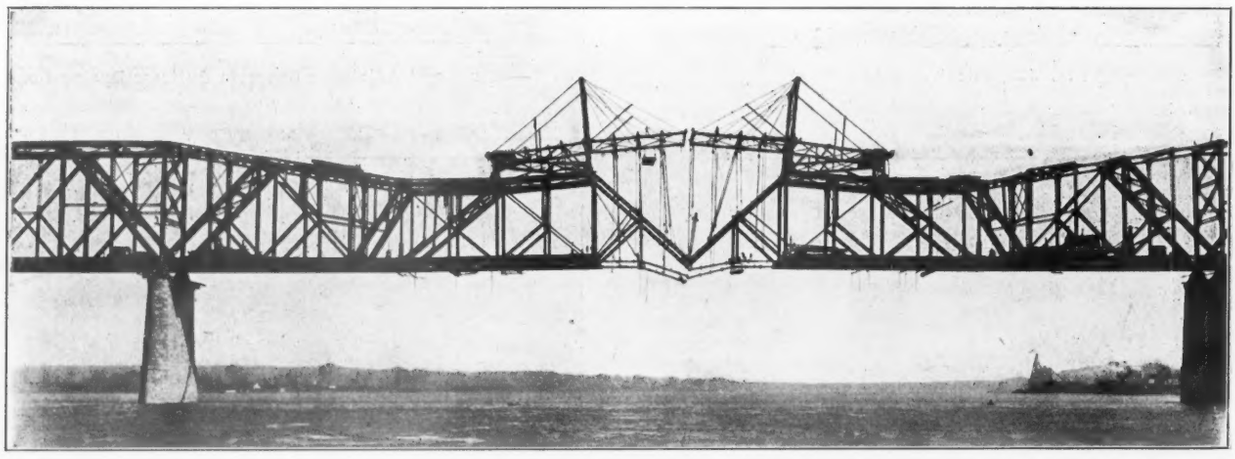


Fig. 12—The Day Before the Final Connection Was Made.

it was only to be used once and a cheaper construction was therefore employed. Fig. 5 shows one of the concrete mixing plants with a Kaltenbach cubical concrete mixer. This mixer was used partly on the construction of the east approach, although the larger part of this approach and the west approach were built with a Smith mixer; however, the cubical mixer was set up in case of emergency. In Fig. 6, pier 1 and the concrete buttress for supporting the adjoining arch are being built up together.

The three succeeding figures show some interesting caisson views. Fig. 7 shows the caisson for pier 3 ready to launch. It was built on two barges which were sunk by flooding, leaving the caisson floating. It was then towed into place and sunk by concreting above the working chamber. Fig. 8 shows the interior framing of this caisson and Fig. 9 shows the caisson for pier 1 built in place and partly sunk in open excavation previous to applying the compressed air. In the background can be seen the sheet piling framing walls for the excavation for one of the concrete piers, also the two travelers with which the concrete approaches were built.

In Fig. 10 may be seen the method employed by the substructure contractors, C. Macdonald & Company, for laying the masonry of all river piers, a traveling locomotive crane being used for the purpose. The masonry of pier 1 was laid by ordinary derricks and of pier 6 partly by this means and partly by a specially built high-derrick barge. Fig. 11 shows the method of bringing the superstructure material to the bridge line. It was loaded on cars in the bridge yard about two miles from the end of the bridge, and the cars were run onto a transfer barge which was towed, for the west end, to pier 4 and moored alongside it. The material was then hoisted with a 50-ton derrick car, seen in the picture, and placed in push cars on the bridge grade.

Fig. 12 shows half of the central span the day before final connection was made. The two center panels of the bottom chord of this span were made of eyebars with the expectation that they would assist in the connecting up of the structure, no falsework having been used in the erection of this span. By means of adjusting wedges, such as are shown in Fig. 12, each half of the central suspended span was raised and the lower center pin holes made to overlap while the

Fig. 13—Wedge Device Used in Making Final Connection.

Fig. 15—Detail of Pier 2 and Superstructure.

Fig. 14—Detail of Expansion Bearing.

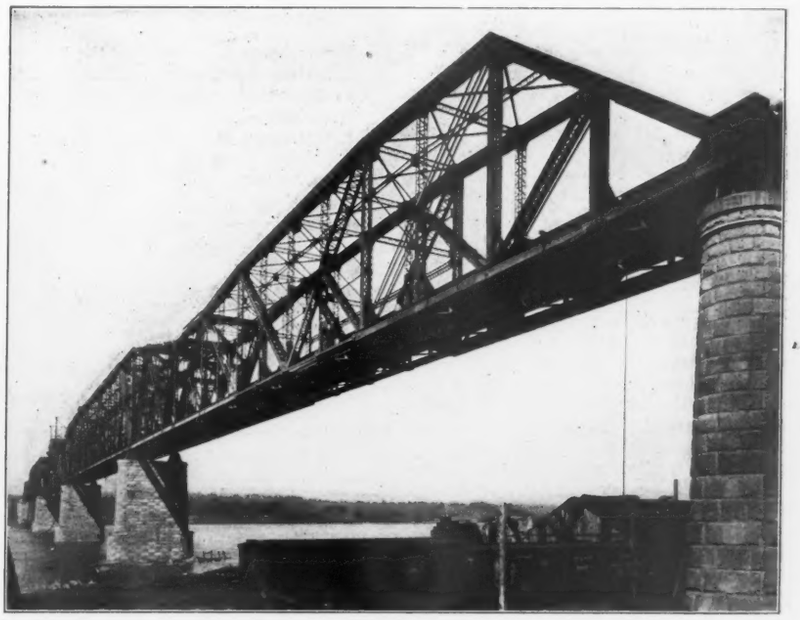


Fig. 16—View of Completed Bridge from the Illinois Side.

center top chord joint was open. There were eight of these wedges altogether, four in the bottom and four in the top chords. They were placed as far in as they would go, thus lengthening the bottom chord and shortening the top chord of the suspended span. They were then slacked off and the bottom chord connection made first. The upper wedges were slacked as the last operation, bringing the top chord into contact at the center of the span.

Although trains are now using the bridge, the formal opening will not occur until the last of this month. The four constituent railroad companies controlling the Southern Illinois & Missouri Bridge Company are the St. Louis Southwestern, Missouri Pacific, Illinois Central and Chicago & Eastern Illinois. Mr. F. H. Britton, Vice-President and General Manager of the St. Louis Southwestern, is President of the bridge company and the principal operating officers of that road will perform similar duties for the bridge company. Mr. J. S. Ford, Secretary and Auditor of the Chicago & Eastern Illinois, is likewise Secretary and Auditor of the bridge company and will also attend to the accounting work.

The Thebes bridge was designed by Messrs. Alfred Noble and Ralph Modjeski, Chicago, who were also engineers for the entire work. Mr. W. E. Angier was Resident Engineer. The contractors for the various parts of the work were: Superstructure, American Bridge Company, New York; concrete piers and foundations, C. Macdonald & Company, New York; concrete approach viaducts, J. S. Patterson Construction Company, Chicago; grading of approaches, McArthur Brothers, Chicago. We are indebted to Mr. Modjeski for information and for a number of the photographs shown herewith.

Installation and Maintenance of Storage Battery for Track Circuits.*

In considering the use of any type of battery on the track circuit one of the first things to be kept in mind is the absolute necessity of battery resistance. This term is here used to mean the resistance through which the current must pass before reaching the rails, whether it be the internal resistance of the battery itself or artificial resistance inserted in series with the battery. In the case of most other circuits such resistance is a disadvantage, a cause of inefficiency; but the track circuit cannot work successfully without it. The exact use of this resistance, however, may not be universally understood; there is possibly an impression that its sole advantage lies in saving current—in preventing an extravagant flow of current when the rails are connected by a train. This is, of course, an important result, but no less important is its effect in reducing the current in the relay coils when the circuit is thus shunted. With clean rails a practically perfect short-circuit is formed by the wheels of a train and the current in the relay coils is, of course, reduced to zero, so far as any ordinary measurement will show. But, under conditions that introduce a small resistance into the shunt formed by the train, a small current continues to flow through the relay, depending upon the relations of the several resistances in the circuit, and the amount of the battery resistance then becomes a vital matter; it may determine whether the relay will open or remain closed with a train on the circuit.

Evidently the battery resistance is limited, as a maximum, to that which will permit a flow of current sufficient to keep the relay working under all conditions; but within this limit it should be as high as possible. This resistance should also be constant. If it varies considerably, everything necessary being so proportioned that the relay will keep working when the battery resistance is highest, there will be more danger of the relay remaining closed when there is some resistance in the shunt formed by the wheels and the battery resistance is low, than there would be if the battery resistance always stayed at its maximum value. For a similar reason it is desirable that the e. m. f. of the battery be as nearly constant as possible; the relay must work when the e. m. f. is low and will then be more likely to remain closed if an imperfect shunt occurs when the e. m. f. is high.

By choice of batteries it is possible to control, within quite reasonable limits, the e. m. f. and battery resistance. But there is one element of the track circuit, the insulation resistance—the resistance of that path formed by the ties, ballast, etc., through which a portion of the current leaks from one rail to the other, that is practically beyond control either as to its actual amount or its variableness. The insulation resistance is, of course, a shunt on the relay, and produces an effect of the same kind as that of the shunt formed by the wheels but less in degree.

Assuming that, in a given case, the shunt is imperfect—that is, that it has some small resistance due to sand on the rails or some similar cause—it is really the joint resistance of the shunt and insulation resistances in multiple that determines what current shall continue to flow through the relay. It is easily seen then that the higher the insulation resistance the lower the shunt resistance must be to bring the joint resistance of the two down to such a value that the current in the relay will be reduced to the releasing point. Therefore, the other elements of the track circuit having been so arranged that the relay will continue to pick up when the insulation resistance is lowest, it is a disadvantage to have this resistance rise considerably if reliability of the relay in opening when trains are on the circuit is alone considered.

If we wish to make calculations of the actual effects of various combinations of conditions, formulas are easily found. The resistance of the two lines of rails and also that of the wires leading from the rails to the relay may generally be neglected. Then if

E represents the e. m. f. of the battery;
b, battery resistance as already defined;
n, insulation resistance;
r, resistance of relay;
s, resistance of (imperfect) shunt;
I, current delivered by battery;
i, current received by relay;

$$I = \frac{E}{b + \frac{nr}{n+r}} \quad \text{and} \quad i = I\frac{n}{n+r}.$$

From these two equations we find

$$i = \frac{E}{b + r + \frac{br}{n}}.$$

From this formula the effect of any conditions on the current received by the relay, or in the direction of reducing that current to the releasing point, may readily be worked out by inserting the actual or assumed values. If a certain possible resistance of an imperfect shunt is assumed, its effect in reducing the current in the relay is found by getting the joint resistance of itself and the insulation resistance as assumed or found by measurement in a particular case, and substituting this joint resistance for n in the formula. From the same equations a formula,

$$b = \frac{E\,n - i\,n\,r}{i\,(n+r)},$$

is derived, which may be convenient in calculating the artificial resistance to be used with a battery having small internal resistance.

From the first formula it is evident that the higher the battery resistance the smaller will be the current at the relay with a given combination of shunt and insulation resistances and hence the more likely is it that the relay will be shunted out. It is also evident that a high resistance in the relay winding itself is beneficial in the same direction; that is, if the battery resistance is fixed and the most unfavorable conditions affecting the pick-up current are settled, the relay resistance should be as high as these conditions will admit. If, however, both the relay and battery resistances are matters of choice, the best theoretical combination can be found by successive trials of the effect on i produced by substituting the various values in the formula. By similar trial calculations it can be shown that a high e. m. f. and the high battery resistance that can be used with it are more favorable for shunting than a low e. m. f. and the necessary low resistance.

The storage battery is particularly well adapted to meet the conditions of the track circuit as here outlined. The e. m. f. of a single cell is comparatively high, much higher than that of other batteries commonly used on track circuits, and is fairly constant; for, although the range between maximum e. m. f. at full charge and the minimum at discharge is wide, the actual variation on discharge in regular service is very moderate. At the same time the internal resistance is so low that it is necessary to use artificial resistance, which has the advantage that it can be adjusted to the requirements as exactly as may be convenient and is free from variation.

A further advantage is that one storage battery can be used to supply track circuits and other circuits at the same time; the internal resistance is so small that variations of the current in one circuit cause no noticeable changes in the difference of potential at the battery terminals and consequently no fluctuations of the current in any other circuit. Finally, the storage is not seriously affected by very low temperatures and, for the low rates of discharge common on track-circuit signal work, does not require underground or otherwise protected shelters.

The cells can be placed above ground in a suitable cast iron base of a signal post or in a case or box between the bracing in the leg of a signal bridge. If the battery is charged in place care should be taken to provide ventilation so that the fumes will be carried off and to protect thoroughly any iron work near the battery; partitions separating the battery from instrument compartments should also be impervious to the fumes.

Where the method of alternate charging and discharging is employed, that is, if duplicate sets of battery are installed and one cell of a pair is charged while the other is supplying current, a simple double-throw multiple switch is used for each pair of cells. When this switch is in one position the two terminals of one cell are connected to the charging circuit and those of the other to the circuit to be supplied, and vice versa. If cells at a number of points are charged in series on a special charging circuit, an additional double-throw switch is needed for each pair of cells, by which the charging line may be connected as a loop to the "charging" switch previously mentioned, or disconnected and cut through.

There is no reason why the two switches

*A paper by C. C. Anthony, Supervisor of Signals, Pennsylvania Railroad, read before the Railway Signal Association at New York City, May 23, 1905.

should not be combined in one so arranged that the several shifts can only be made in the proper order, except that such a switch, if made with proper clearances for a high potential charging circuit, is likely to be inconveniently large. Some switches of this sort heretofore used have proved unsatisfactory because, for the sake of saving space, the parts connected with different circuits were placed too close together and not sufficiently insulated; as a result arcs formed between such parts have occasionally caused damage.

The method of charging the batteries for automatic signals and track circuits on a considerable length of road through a series charging line from a 500-volt dynamo, and the method of handling portable storage batteries for the same service, have recently been so fully described in the paper of Mr. Reynolds, presented at a previous meeting of this Association, that it is unnecessary to go further into details here.

It is a tradition of the track circuit that both the relay and battery should be located as near as practicable to the point of connection to the rails so that the wire resistances between them and the track will be very small. This rule has no application to storage battery, however. Since resistance must be introduced between the battery and track, a part of this resistance may just as well be in the connecting wires as in coils made specially for the purpose. The battery can, therefore, be located at a considerable distance from the end of the circuit on the track, if there is any advantage in doing so, and the artificial battery resistance can be reduced by an amount equal to that of the long leads.

The resistances are simple coils of any convenient form; the chief requisite is that the wire and the surface be large enough so that the current flowing when the track is short-circuited will not cause overheating. Where the same battery is used to supply other circuits it may be an advantage to provide the resistance coils with iron cores so that they will act as choke coils to prevent the passage, between the track and other circuits, of discharges due to lightning.

It is usual, in this double use of the battery, to insert two resistances on each track circuit, one in connection with each pole of the battery, so that neither side of the other circuits connected with that battery will be grounded on the track. There is a good deal of doubt in the mind of the writer as to whether there is any advantage in this arrangement; it is a question whether it is not better to have one side of the signal circuits grounded so that an accidental ground on the other side may show itself by cutting out a signal before worse trouble is caused by a combination of grounds on that side of the circuit in which the circuit-breaking devices are connected. It must be admitted, however, that, where the same battery is used for track and signal circuits, a good independent ground could not be put on the signal circuits, as, for example, on the air pipe in the case of electro-pneumatic signals; the result would undoubtedly be excessive leakage on the track circuit.

While it would be possible, by the method already explained, to calculate the battery resistance suited to the conditions in each case, it is, of course, hardly advantageous to do this in practice and to have a variety of different resistances on different circuits; it is practically necessary to settle upon one resistance and use it on all circuits of the same general character. For a single cell of storage battery, e. m. f. about two volts, a resistance of two ohms is found to be satisfactory with relays adjusted to pick up with .015 watt. Where the batteries are used for signal and track circuits two coils of one ohm each are put in. The current taken on short circuit of the track is, of course, about one ampere.

On the Pennsylvania Railroad nine-ohm relays, picking up with .041 ampere, were at one time generally used but it was found that they failed too frequently when conditions were unfavorable on account of wet weather, etc. So far as those circuits supplied by storage batteries are concerned the battery resistances might have been reduced and the nine-ohm relays retained; but, as there was the same trouble on circuits using gravity battery, it was decided to reduce the standard relay resistance to five ohms, pick-up current .055 ampere, and the battery resistance used with storage battery remains at two ohms.

Supplying two or more track circuits from the same single-cell battery, especially the long circuits used with automatic block signals, has not proved altogether satisfactory in practice. The principal trouble has, however, been caused by the stray currents in the earth, coming from electric roads. Where two track circuits are practically in connection with each other through the small resistances used with one cell of storage battery, these currents are likely to cause disturbances that would not occur if the circuits were entirely separate. It may therefore be laid down as a general rule that each long track circuit should be insulated on both rails at both ends and should have its own source of current.

The same battery used for a track circuit may, without any practical disadvantage, supply current to insulated signal circuits, although it is safer if these do not extend to any great distance and are not connected to a general common return wire, as perplexing troubles due to grounds at distant points may thus be avoided.

For the actual work of installing the cells the first and last word is, follow the directions. Cells rated at 80 ampere-hours, normal charging rate 10 amperes, are quite satisfactory for single track circuits or for one track circuit and one or two signal circuits in connection with it. The chief difficulty, where the method of series charging is used, is to furnish the normal charging current for the initial charge. The current is likely to be limited by the resistance of the charging line to a point below the normal charging current for the battery so that, even though only a few cells are charged at a time, it may not be possible to send that amount of current through them. Fortunately it is not absolutely necessary that the first charge be given at that rate; very good results may be obtained, especially in the case of battery to be used in such light service as that under consideration, by charging at a lower rate for a longer time.

As explained in a recent article on supply of current to interlocking plants, at an interlocking or push-button plant where current is used at moderate voltage, 20 volts or less, it is more convenient to supply the short track circuits likely to be needed within the limits of the interlocking, directly from the main battery or motor-generator if one is used, through suitably high resistances, than to provide a large number of separate cells and their charging switches and connections.

There is not usually the trouble from foreign current and heavy leakage on these short circuits that is met with on longer ones; at the same time it is convenient to arrange such circuits with one side of each in connection, through the switches and crossovers, with the corresponding side of all the others. The common return wire of the plant can then be connected directly to the "common" rails of the several track circuits at convenient points while the insulated side of each circuit receives current from the other main supply wire or terminal for the plant through a single high resistance. Resistances from 75 to 140 ohms, according to conditions, have been used at plants with which the writer is familiar and 20 or 30 short-track circuits are sometimes supplied at one plant. A peculiarity of this method is that, as the battery resistance is much the largest part of the resistance in each circuit, the current delivered is but slightly increased when the track is short-circuited; and of course this arrangement is very favorable to the effective shunting of the relay.

The disturbing effect on track circuits of the stray currents flowing through the earth from electric railroads has already been referred to incidentally. If this disturbance were confined in its results to occasional failures of signals in the danger position it might not be cause for very great concern. But when we consider that, where such currents are of considerable strength, so likely a defect as the failure of the insulation in an insulating rail joint may cause a signal to clear with a train in the block, it is evident that the situation is somewhat serious; and as the area covered by electric railroads increases and the volume of return current grows with the increase in number and weight of cars, the danger of "clear" failures of automatic signals from this cause is undoubtedly increasing from year to year. Alternating current, in combination with relays adapted to respond to such current only and to be unaffected by direct current, has, of course, already been used to a limited extent for track circuits on electrically operated roads; and, unless operation of electric roads by alternating current should have a very rapid introduction, it seems not unlikely that the use of alternating current as a protective measure on the track circuits of steam roads may become urgent in the next few years.

With the alternating current used on the track circuits, one advantage of the storage battery, that of furnishing for a reasonable time a local source of current unaffected by accidents to the power line or generator, would of course be lost, and all efforts would have to be devoted to placing the lines and generating plants practically beyond the possibility of any prolonged failure. The line is the most serious problem but it is safe to say that, under the pressure of necessity, by thoroughly substantial construction it could be made reliable; although it might be necessary to place it in conduit under or near the surface of the ground. However, these considerations need not as yet withdraw all attention from the storage battery.

The maintenance of the storage battery, to whatever use it is put, is well covered by the directions of the makers. It naturally happens, however, that some differences of method develop in different localities. The conditions on automatic block signal circuits are very favorable for the battery. The cells are chosen of such size and are so handled as to maintain a good reserve capacity against a breakdown of the power line; consequently they are worked at a low rate and are never, in regular service, carried anywhere near full discharge. As a result it is rare that any defect develops and very frequent inspections and elaborate tests seem hardly necessary.

Where the batteries located at automatic signals along the road are charged on a series charging line, it is necessary that charging be done every day so that a good reserve will always be available for emergencies. The principal item of maintenance is then the daily trip of the batteryman to reverse the charging switches; but, as other work can generally be combined with these

trips, only a moderate fraction of the batteryman's time is chargeable to battery maintenance. As these regular visits must be made it is common practice to have the batteries tested at each visit; the necessary tests take only a few minutes at each point. Charging is regularly done at night so that the inspecting and changing of switches is done while the charging line is dead.

Following are the methods of inspection on four divisions of the Pennsylvania Railroad, on which 990 cells are in service on this plan:

On one division, having 290 cells, the switches are changed by the lampman who takes the specific gravity of the electrolyte in all cells on each trip. The repairman takes the voltage once a month.

On another division, having 244 cells, the batteryman, at the time of changing the switches, takes both the specific gravity and the voltage of each cell daily and sends the record to the Signal Foreman on a form provided.

On a third division, where 200 cells are in service, the lampman changes the switches but makes no tests or inspection other than noting the general appearance of the cells. The specific gravity and voltage of all the cells are taken and recorded on the forms every three days.

On the fourth division, with 256 cells, the batteryman changes the switches and takes the specific gravity and voltage of all cells daily. Thus there is some diversity in the routine but so far the results everywhere seem to be satisfactory.

One hundred and forty-two cells in one group have been in service an average of three and a half years. Other groups have been working for various periods from two years down to seven months. In these 990 cells, with an average service of about a year and a half, six new elements have been used for renewals, three broken jars have been replaced, and four carboys of electrolyte and a small quantity of distilled water have been used on account of evaporation. Part of these cells are of 80 ampere-hour capacity and part 160 ampere-hour.

Only one division gives the batteries any extra charging; this amounts to about 50 ampere-hours once each month. The charging current is from five to six amperes except on one division, where it is from three and a half to four. The time of charging is from 10 to 13 hours. The discharge varies considerably on account of the large current taken when the track is short-circuited. The average is about one and a quarter amperes for the large cells, which supply two tracks, and half that for the smaller size.

On another division there are eight sets of battery floating as a reserve in connection with motor-generators constantly running to supply current to interlocking plants and track circuits. There are 53 cells, all of 160 ampere-hour capacity except seven 320 ampere-hour cells, which have been in service from one to three years. But two regular tests of specific gravity and voltage have been made on these cells in a period of one year. Although all cells were found to be in good condition it is believed to be better to make such tests at least once a month.

The repairmen regulate the voltage of the generators so that the current through the batteries varies between a slight charge and a slight discharge but averages about zero. Each battery is discharged on the plant eight or ten hours twice a week; the rate is from three to seven amperes at different plants. The battery is then fully charged again and allowed to float as before. The only material used has been 20 gallons of distilled water, at 2 cents per gallon, sent to each plant.

A glance backward over the data that it has been possible to bring together here, however, leads to the conclusion that the storage battery is almost perfectly adapted to meet the special requirements of the track circuit; is easily installed and maintained; and is thoroughly satisfactory in service.

Acceleration Tests of Steam and Electric Locomotives.

On April 29 the New York Central and the General Electric Company conducted a series of six tests to determine the relative accelerating power of the new electric locomotives which are to be used for hauling through trains within the electrified zone of the Central around New York and a Pacific (4-6-2) type heavy passenger locomotive. The tests were made on the experimental track, six miles long, which is a section of old track No. 4 of the main line, formerly used for eastbound freight trains, and extends from mile-post 162 to mile-post 168 between Schenectady and Hoffmans. The track is laid with standard New York Central section 80-lb. steel rails, six-bolt splice plates 36 in. long, 16 yellow pine ties to each 30 ft. rail length, gravel ballast, well surfaced and the curves are elevated for a speed of about 70 miles an hour. The alinement and grades are shown on the condensed profile. It will be noted that westbound from the east end of the experimental track at mile-post 162, the grades are rising, varying from 5 to 17 ft. per mile. The summit is between mile-posts 166 and 167 and from that point the track descends on grades varying from 6 to 19 ft. per mile. In the stretch of six miles there are seven curves varying from 0 deg. 48 min. to 2 deg. 17 min., the longest tangent being 7,565 ft.

The power for testing purposes is furnished by the General Electric Company from a 2,000-K.W., three phase, 25-cycle, Curtis turbo-generator delivering current at 11,000 volts. This generator has been installed at the company's works in Schenectady and a special high-tension transmission line five miles long, has been constructed to a sub-station near mile-post 165. This sub-station contains a 1,500-K.W., 650-volt rotary converter with static transformers for reducing the transmission line potential from 11,000 volts to 475 volts. Direct current is delivered from the rotary converter to the working conductor, which consists of a top-contact, 70-lb. steel rail reinforced with copper and covered in part with a board protection. At four road crossings, an overhead construction is used to cover gaps where the use of the third rail is inadmissible. Experiments are about to be started with a new form of under-contact rail which it is believed will do away with many of the disadvantages of the ordinary top-contact third rail.

The accompanying diagram shows the comparative weights and dimensions of the steam and electric locomotives. The electric locomotive was quite fully described in the *Railroad Gazette*, November 18, 1904, and the steam locomotive tested is almost identical with the Pacific type engines for the Michigan Central, illustrated and described in the *Railroad Gazette*, April 29, 1904. It will be seen that the weights on drivers are practically the same; as is the driving wheel base. The test trains were made up of six and eight cars and had the following weights:

Eight-Car Trains.

Trains					
Electric.			Steam.		
No.	Car No.	Weight.	No.	Car No.	Weight.
1	1060	101,900	1	2527	79,900
2	1070	100,400	2	1547	86,100
3	1082	106,200	3	1534	87,800
4	1092	100,100	4	1521	84,500
5	1097	104,650	5	1069	86,300
6	1550	102,800	6	1099	87,400
7	1552	106,000	7	1563	86,400
8	1558	104,750	8	1513	86,700
Loco.	....	200,500	Loco.	....	342,000
Total, tons		513.6	Total, tons		513

Six-Car Trains.

Trains					
Electric.			Steam.		
No.	Car No.	Weight.	No.	Car No.	Weight.
1	1060	101,900	1	2527	79,900
2	1070	100,400	2	1547	86,100
3	1092	100,100	3	1534	87,800
4	1097	104,650	4	1521	84,500
5	1550	102,800	5	1069	86,300
6	1558	104,750	6	1099	87,400
Loco.	....	200,500	Loco.	....	342,000
Total, tons		407.5	Total, tons		427

The tests were started 8 a. m. and were continued until 1 p. m. The average temperature was about 50 deg. F. and the weather was cloudy, but during the tests no rain fell, so that the rails were perfectly

Run "D." Electric Locomotive Leading by Train Length 1,500 Feet from Start of Test.

dry. On account of the restricted cross-section of the conductor rail, the voltage dropped during acceleration considerably lower than will obtain in actual practice within the electrified zone around New York, as is shown by the following table of average voltages:

Average Voltage During Acceleration.

	Series.	Series-multiple.	Multiple.
Run A	520	540	325
" B	620	520	275
" C	600	540	330
" D	680	680	515
" E	650	600	420
" F	600	620	455

The results obtained in these comparative tests, therefore, are much less favorable to the electric locomotive than will be secured in actual practice. The following is the log of the runs:

Run A.—The Pacific type steam locomotive had an 8-car train with a total weight, including the locomotive, of 513 tons, as compared with the 8-car train behind the electric locomotive weighing 513.6 tons. Both trains started together, with the steam locomotive accelerating faster than the electric locomotive, due to the abnormal drop in voltage from the pressure at the station of 700 volts, to a track voltage as low as 325 volts. At 3,000 ft. from the starting point the electric locomotive attained the same speed as the steam locomotive, and from that point accelerated more rapidly, so that at a distance of two miles from the starting point the electric locomotive passed the steam locomotive, and at the shutting off point was two train lengths ahead. The maximum speed of the steam locomotive was 50 miles per hour. The maximum speed of the electric locomotive was 57 miles per hour.

Run B.—This run was made under the same conditions as run "A," with results practically the same, except that the speeds were higher. Maximum speed of steam locomotive, 53.6 miles per hour. Maximum speed of electric locomotive, 60 miles per hour.

Run C.—This run was made with 6-car trains for both locomotives, with total train weights as follows: Electric locomotive, 407.5 tons; steam locomotive, 427 tons. Owing to extreme low voltage under the conditions above stated, which during acceleration fell as low as 330 volts, at first the steam locomotive accelerated more rapidly, but at the end of about a mile the electric locomotive overtook the steam train and continued to forge ahead until the power was shut off. Maximum speed of electric locomotive, 61.6 miles per hour. Maximum speed of steam locomotive, 58 miles per hour.

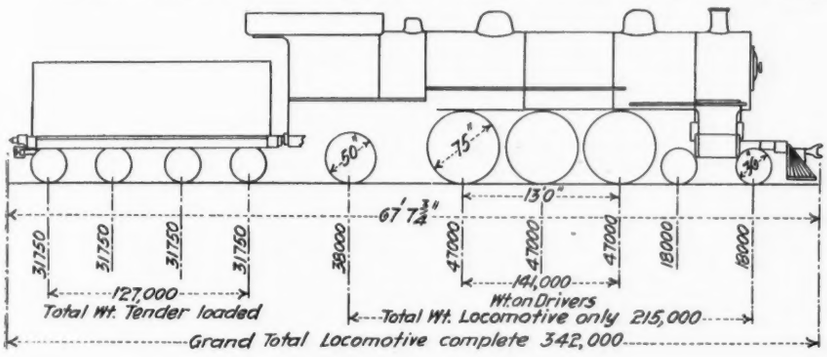
Run D.—In order to secure as nearly as possible results comparable with the conditions of voltage that will obtain in the actual operating zone, this run with 6-car trains similar to those used in run "C" was started at a point nearer the sub-station, at milepost 164. For this run the electric locomotive from the first turn of the wheels accelerated faster than the steam locomotive, as shown in the accompanying illustration from a photograph taken at a distance of 1,500 ft. from the starting point. The electric locomotive led by a train length at this point. The diagram shows the acceleration and speed time curves for this run.

Run E.—This run was made with the electric locomotive and one coach, and a maximum speed of 79 miles an hour was attained.

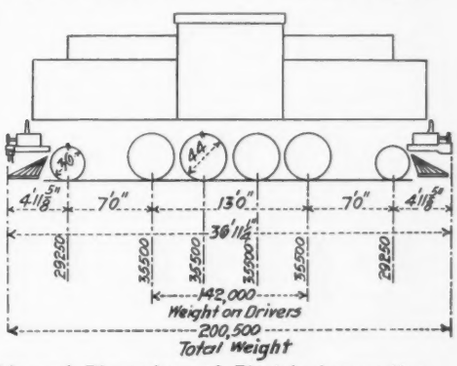
Run F.—This run was made with the electric locomotive running light and with power shut off on curves. A maximum speed of 80.2 miles an hour was attained. Had it not been necessary to shut off the current on curves, it is believed that the locomotive would have attained a speed of over 90 miles an hour in this comparatively short run. A speed test made two days later reached 85 miles an hour with a limitation on the 2 deg. 17 min. curve of 78 miles an hour.

At all speeds the smooth riding qualities of the electric locomotive were very noticeable, especially the absence of "nosing" effects. After the runs the track was carefully examined and no tendency to spread rails was discovered. However, on the sharper curves the high speeds caused the track to shift bodily in the ballast, due to insufficient super-elevation of the outer rail.

The most important test was run "D," as the voltage during that test more nearly ap-

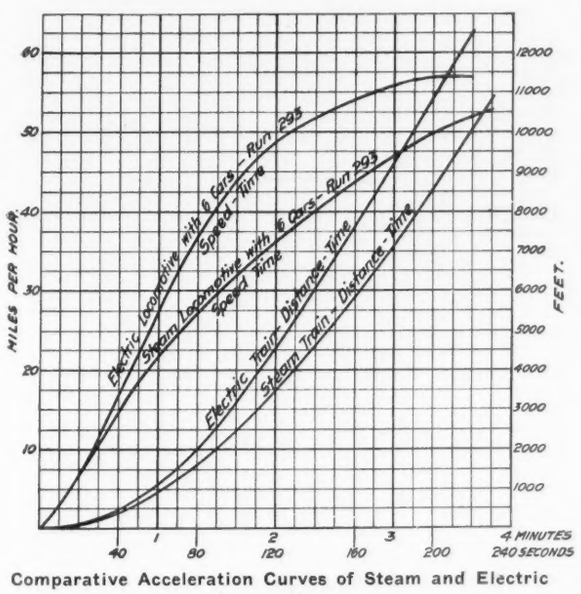


Weights and Dimensions of Steam Locomotive.

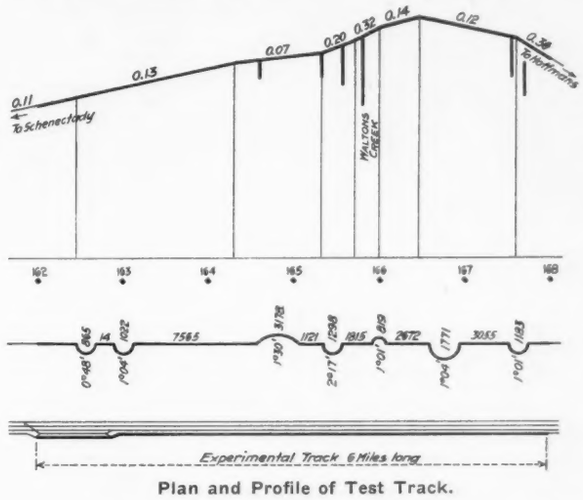


Weights and Dimensions of Electric Locomotive.

	Steam.	Electric.	Difference in favor of Electric.
Length, over all	67 ft. 7¾ in.	36 ft. 11¼ in.	30 ft. 8½ in.
Total weight (includg. tender for steam locomotive)	342,000 lbs.	200,500 lbs.	141,500 lbs.
Concentrated weight on each driving axle	47,000 "	35,500 "	11,500 "
Revenue bearing load back of locomotive	256 tons.	307.25 tons.	51.25 tons.
Acceleration M. P. H. P. S., average up to 50 M. P. H	0.246	0.394	0.148
Time required to reach speed of 50 M. P. H.	203 sec.	127 sec.	76 sec.



Comparative Acceleration Curves of Steam and Electric Locomotives.



Plan and Profile of Test Track.

proached the conditions that will be obtained in the electrified zone. Therefore, the following comparison of the steam and electric locomotives, based upon the results of run "D," are interesting as showing the marked superiority in acceleration of the electric locomotive over the steam locomotive, considering the fact that the Pacific type locomotive has practically the same weight on drivers.

The tests were witnessed by Mr. W. J. Wilgus, Vice-President, and Mr. E. B. Katte, electrical engineer of the New York Central, and by Mr. E. W. Rice, 3d Vice-President; Mr. W. B. Potter, Chief Engineer, Railway Department, and Mr. A. F. Batchelder, Engineering Department of the General Electric Company.

New Locomotives for the Baltimore & Ohio.

The announcement that the Baltimore & Ohio has recently closed contracts for 250 locomotives is not only interesting when considered from the standpoint of the magnitude of the order but also from the fact that the whole number, with the exception of five switching engines, are included in two classes. It shows a tendency towards the reduction of standards that is very marked.

The switching engines, which were ordered from the Baldwin Locomotive Works, are of the six-wheel type, and are intended for work at the New York terminal.

The principal dimensions are as follows:

Weight	135,000 lbs.
Diameter of cylinders	19 in.
Stroke of pistons	24 "
Diameter of drivers	52 "
Steam pressure	180 lbs.
Heating surface	1,590 sq. ft.
Grate area	73.3 "

Of the remaining 245 engines that were ordered, 210 are to be consolidations and the balance of the Pacific type.

The principal dimensions of the former are:

Total weight	202,000 lbs.
Weight on drivers	180,000 "
Diameter of cylinders	22 in.
Stroke of pistons	30 "
Diameter of drivers	62 "
Steam pressure	200 lbs.
Tubes: No. 284; outside diameter	2¼ in.
Heating surface	2,820 sq. ft.
Grate area	56.5 "
Tank capacity	7,000 gals.

The general dimensions of the Pacific (4-6-2) engines are:

Total weight	220,000 lbs.
Weight on drivers	149,000 lbs.
Diameter of cylinders	22 in.
Stroke of pistons	28 "
Diameter of drivers	75 "
Steam pressure	200 lbs.
Tubes: No. 286; outside diameter	2¼ in.
Heating surface	3,545 sq. ft.
Grate area	565 "
Tank capacity	7,000 gals.

The Railway Signal Association.

The regular meeting of this association was held in New York City on Tuesday of this week, President J. C. Mock in the chair. A large number of new members were admitted. The committee on definitions requested that the portion of the programme dealing with their subject be re-committed, and the meeting did so. Consideration of definitions in a meeting of the whole association has proved unprofitable and the committee now intends to confer with the M. W. and other kindred associations. A resolution was passed directing the secretary to furnish each member of the association with a numbered badge, with a view to making it easier for members to get acquainted with one another at meetings.

The first paper was one on Discipline of Trainmen in connection with Automatic Signals, by R. G. Kenly, a trainmaster on the Lehigh Valley. Mr. Kenly pointed out the difference between bad and good discipline. The dictionary definitions are "correction, chastisement, punishment intended to correct errors" and "education, instruction and government, comprehending the communication of knowledge and the regulation of practice." We must devote ourselves to the latter kind.

In the discussion on this paper Mr. Elliott (N. Y. C.) spoke of a very useful functionary, presumably on his own road, called a chief signalman. This man is on the staff of the superintendent and represents the superintendent in consultations with the signal department. Some superintendents have adopted a rule to take out of the service an engineman who runs the length of more than one block section under caution. Whether this means suspension or dismissal Mr. Elliott did not say. To run past a stop signal should mean dismissal, and the dismissal should not be one of that kind which is forgotten in a few weeks and the man taken back. Surprise checking is advisable. Mr. Kenly had spoken of an engineman who left a siding following a passenger train and disregarded the next block signal. The speaker advocated an indicator at the siding which should show red until the block section in advance is clear. If there be no indicator, a five-minute interval should be enforced.

Mr. Anthony (P. R. R.) inquired about the functions of the "chief signalman"; the existence of such an officer indicates that a superintendent needs an expert; that he is not sufficiently expert himself. It also indicates that the signal engineer is not an expert in discipline. Why should not the signal engineer aspire to furnish to the superintendent all the expert knowledge he needs in this field?

Mr. Elliott, replying to a question, said that a chief signalman would be useful on a division with as few as 20 towers.

Mr. Gray, replying to a question, said that on the Pennsylvania Lines West of Pittsburg the supervisors of signals make the examination (on signals) of enginemen and firemen who are candidates for promotion.

Mr. Morrison (Erie).—Our division operator supervises the towermen. The division operator is charged with the duty of seeing that signals are operated properly, and hires and discharges all operators, both in towers and in stations.

Mr. A. R. Raymer (P. & L. E.).—One of the strong points in Mr. Kenly's paper is his assertion that discipline of enginemen should be administered regardless of misconduct. One engineman had told the speaker, in confidence, that the great majority of runners would be glad to co-operate in weeding out the few black sheep; the few runners who have not the conscience to obey signals.

Mr. Rudd (P. R. R.).—Surprise checking, spoken of by Mr. Elliott, is an essential element in good discipline. On a certain division where the enginemen at first thought that this surprise checking was a "put up job" they now like it. It exposes the reckless men; if properly conducted it will finally be appreciated by the good enginemen.

President Mock (M. C.) asked for views as to the effect on discipline of putting distant signals far back, say, three miles, as in the case of an automatic block section of that length. Mr. Anthony pointed out the objection to long distances. The only function of the distant signal is to apprise the runner of the position of the home signal and of his duty at that signal. The attempt to prescribe by rule what an engineman shall do at the distant signal is always a failure.

Mr. Rudd.—While three miles is an excessive distance we must remember that we have long since grown out of the short distances formerly regarded as proper. The distant signal must be far enough back to warn the fastest train, at night, with the light extinguished; that means 4,000 ft. to 5,000 ft. But as blocks one mile long are about as economical as any, such an arrangement brings the distant signal about where it is wanted. On the C., N. O. & T. P. the distant signal rule is that an engineman, after passing it in the horizontal position, must reduce his speed so as to be able to stop within half of the distance which he can see; if he can see the track for 1,000 ft. he must be able to stop within 500 ft. The chief objection to the remote distant signal is that trains will enter the main line from a siding after a superior train has passed the distant. On the Pennsylvania at new interlockings the distant signals are being set 3,000, 4,000 and 5,000 ft. back. Approach locking is put in to assure the train of its route. Approach locking is now put in on that road at all interlockings on main lines; at all on branch lines where derailing switches are used, and at other points on branch lines if required by the superintendent.

Mr. Anthony and other speakers emphasized the importance of surprise checking.

Storage Batteries.

The paper by Mr. Anthony on storage batteries for track circuits, which appears in another column of this issue of the *Railroad Gazette*, was not read, the members having received advance copies. The discussion was participated in by a considerable number of members, but brought out little of importance except amplifications of statements made by Mr. Anthony. Replying to a question, Mr. Anthony said that he had never tried to operate several track circuits from a common source, as described in his paper, except in connection with electro-pneumatic interlocking plants, where the circuits are not over 20 volts. The arrangement would not be satisfactory with a long track circuit. He had worked four track circuits to distant signals on a four track line, all from a motor used to work switches, and used also for a dozen short track circuits, but there was a large leakage. Every long track circuit should be entirely independent.

Mr. Elliott spoke in favor of the use of track circuits in place of detector bars. With 100-lb. rails now common the width of the head of the rail is so great that outside detector bars are unsatisfactory, and no one has yet devised a satisfactory inside detector bar.

Mr. Rudd.—For the past year all our new interlockings have been put in without detector bars. Track circuits which are over 500 ft. long are kept separate from circuits working signal instruments.

Mr. Balliet.—With a common rail for several track circuits, relays have been known to give false indications; but this was probably due to a current produced by the difference in potential between a very long rail conductor and a short rail conductor.

Mr. Elliott and others confirmed Mr. Anthony's statement that with storage batteries the battery men must be held very rigidly to compliance with the regulations. Mr. Elliott spoke of the trouble with foreign currents, which constitute an increasing disturbing element with track circuits. An alternating current for the track circuit will meet the trouble, but on a steam railroad the alternating current is very costly. Moreover, with an alternating current the storage battery is unavailable.

Mr. Rudd.—And that makes it probably cheaper to use lock and block.

Mr. Elliott.—That is by no means certain. The alternating current is costly, but operators may be found still more costly.

The discussion having turned on the behavior of track circuits generally, one member spoke of an experience on a section of track several miles long which, because of a washout, had been unused for three days. A light locomotive running over

this line failed to open the track relays of one or more sections; finally, the trouble being noticed, the engine was quickly stopped; and the severe application of the brakes, sliding the driving wheels for a short distance, cleaned the rails and shunted the current so as to set the signal at stop. Mr. Henry (L. V.), measuring a track circuit about 2,500 ft. long had found its resistance .17 ohm. The resistance of the feed wire was .08 ohm. Mr. Anthony had measured a piece of track with new bonds 2,400 ft. long and found it .1 ohm; a piece 4,500 ft. long showed .5 ohm.

Afternoon Session.

Mr. J. M. Waldron, Signal Engineer of the Interborough Rapid Transit Company, presented an interesting paper showing the excellent behavior of the automatic signals on the express tracks of the subway since the opening of that line last October. A notice of this paper must be postponed until a future issue.

Mr. W. H. Elliott, of the New York Central, presented a paper on the semaphore spectacle in which he offered a design (with three openings) so proportioned that the force tending to return the arm of the signal to the horizontal position would be the same throughout the whole of its movement. Mr. Elliott favors a semaphore moving through an arc of 60 deg. The purpose in designing this "constant pull" form of casting was to provide as well as possible against drooping signals. The common style of casting, designed to exert the greatest force when starting from the clear position, is not favored by Mr. Elliott. He deems it equally necessary to have a maximum force exerted near the close of the stroke.

The general question of spectacle castings being brought into discussion, Mr. Rudd spoke of the practice on the Pennsylvania and on the merits of different designs. The speaker was in favor of moving the arm down 75 deg. from horizontal for the all-clear position, in all signals, whether two-position or three-position. If three-position, the caution indication would be 37½ deg. He would abandon the use of the back light but would retain the back light casting, which could be changed in design for different counterweight demands, leaving the main spectacle plain, and uniform for all patterns of semaphore. In automatic internally connected signals Mr. Rudd would favor a wire to pull the signal to the clear position, employing gravity to move it to the stop position. To have a heavy vertical rod and then add a dash-pot to counteract its heaviness is unscientific.

Sentiment on the Pennsylvania seems to be in favor of semi-automatic signals at all cabins. Even with the telegraph block system there should be a track circuit of 1,000 ft., more or less, to return the signal to the stop position.

After a long discussion of Mr. Elliott's proposal, a motion was made to adopt his conclusions as the voice of the association; but as radical differences of opinion developed, and as a number of members desired to further study the subject, the matter was finally referred to a committee, with instructions to get the views of members of the association by letter ballot.

Inquiries concerning behavior of storage batteries brought out the statement from Mr. Henry that such a battery on a drawbridge jarred by the vibration of the operating engine suffered no impairment.

At the close of this discussion Mr. J. W. Gladstone, of the Battery Supply Company, read a paper giving statistics of the cost of primary batteries in signal work on the Central of New Jersey and other roads, controverting statements made in a recent paper by Mr. Reynolds to the effect that storage batteries were cheaper than primary batteries.

Mr. Lawrence Griffith, having left the railroad service, resigned his place as Vice-President of the association, and Mr. C. H. Morrison, of the Erie, was elected in his place.

The Yetman Transmitting Typewriter.

The speaker before the May meeting of the New York Railroad Club was Mr. Charles E. Yetman, inventor of the Yetman transmitter, who read a paper on the "Evolution of the Telegraph in Railroad Work." Mr. Yetman described the experiences, familiar to most railroad officers, of the young man from the country learning Morse telegraphy. Discussing the philosophy and technique of sending, he said:

In the transmission of the word "telephone," 36 muscular movements are necessary and the mind must act 36 times in measuring the intervals of time between these movements. In the word "good" which is of less than average length, 20 muscular movements are necessary, leaving out of account the so-called mental measurements. An expert telegraph operator must move one set of muscles in his sending hand 800 times in sending 40 such words a minute, 48,000 times an hour and 384,000 times in an eight-hour day. Does it seem strange, then, that telegraph operators suffer from lameness of the muscles in the sending hand and become totally disabled? No man except a telegraph operator has ever been called upon to endure such a strain. . . . On a telegraph circuit running from New York to Chicago, equipped in the best manner possible under the most favorable circumstances, we have a constantly-varying battery force. A telegraph operator commences to work such a circuit in the morning and after a few minutes of so-called limbering up, he settles down into a fairly uniform rate of transmission with the Morse key. After an hour or two of rapid work with, as I have already pointed out, 48,000 muscular motions per hour, his contacts are not so uniform. Some light dots occur and in a long circuit drop out entirely. There is then an adjustment of repeaters and serious delay. This occurs many times during the day and is, of course, often due to storms and atmospheric changes but much more often to the faulty sending of a tired operator.

As telegraph operators we were never taught anything. If we are now intelligent our knowledge was secured solely through experience. Men and women serving an apprenticeship in all the other skilled professions are guided by competent teachers and their progress is based upon principles which are sound and are at the very beginning of the work carefully laid down for them. . . . The telegraph operator has no teacher, has no instructions, has no principles laid down to guide him in becoming skilful in his profession. He begins his apprenticeship by being turned loose in some office where he learns telegraphy as I did under the most adverse circumstances. He works with the most expensive tools of any worker in any profession. He shares with his receiving operator the responsibility of producing revenue from a wire with telegraph equipment representing an investment of many thousands of dollars. Any increase in his skill under such circumstances would produce tangible results at once in the way of increased revenue. . . . .

Summing up the facts brought out we have learned first, that the telegraph operator acquires his skill without scientific training. Second, the transmitting mechanism he uses is crude and has not been improved in 60 years and finally destroys him. Third, the equipment he works with represents a larger investment than that of any other worker. Fourth, the lives of the passengers on our railroads and the property of the company as well depends upon the accuracy of his work. Fifth, that he is a permanent institution and will probably have to be reckoned with for many years to come.

It would seem, then, that the telegraph operator is of enough importance to warrant our giving him some attention. What are we going to do about it? I answer in the first place, train him. The railroad telegraph office is the best place in the world for him to acquire the necessary knowledge. Give a little attention to the instruction he receives there and require the telegraph operator whose assistant he is to give him the necessary instruction and practice. Let him be taught to take hold of the key properly and send the Morse signals slowly and regularly until he becomes a thorough expert. Show him the kind of motion necessary to make dots and dashes which will carry over long, weak and improperly adjusted circuits.

In the second place, encourage him to use the typewriter. The railroad telegraph operator in the large majority of offices has a great deal of leisure time. He is intelligent, ambitious and reliable. Advise and help him to purchase a visible writing typewriter so that while he copies messages from the wire he will not be obliged to lift the carriage to see what he is doing. Other users of the typewriter may have time for that operation, but the telegraph operator listening to the wire, interpreting the Morse signals and operating his machine, must keep up with the sender, and needs a visible writing machine. Place in his hands graded lessons for practice upon the keyboard. Teach him to assign each finger of each hand to certain keys in the keyboard and to always strike those keys with the finger to which they have been assigned, so that he will presently find that his fingers have become automatic.

Show him that he can operate the keyboard of a typewriter vastly more easily, accurately and swiftly without looking at it and that it is a mistake to attempt to direct his quick fingers with his slow eyes. Encourage him to do all his office work on the typewriter. Give him to understand that the preparation of his monthly reports upon the typewriter will be noticed and appreciated. Teach him to copy train orders with the typewriter so that he can hand to the waiting conductor and engineer those messages of life and death, transcribed in such a manner as to be absolutely legible and upon a kind of paper which is not easily destroyed.

This work can be accomplished very easily. It can be done with but slight expense to the railroad company. It will result in developing a force of telegraph operators whose efficiency will surprise and delight those who have had a hand in the work. From this force of trained men you will be able to select train despatchers capable of the fastest and most accurate kind of telegraph work, and the increase in the efficiency of the telegraph department as a whole will be felt in every department of the administration of the railroad company.

Mr. Yetman then went on to give a brief description of his machine, which consists of three parts; a visible writing typewriter, a mechanical transmitter for sending perfect Morse letters at any speed, and a keyboard. By turning a lever the keyboard can be connected at will either to the transmitter (for sending) or to the typewriter (for use by a Morse operator in writing out messages as

he receives them by ear), or to both together, so that in sending the operator will write a copy of what he sends.

Report of the Illinois Railroad and Warehouse Commission.

In the current report for the year ending June 30, 1904, the commissioners point out that for the first time in many years there is not a single line of steam railroad within the borders of the state in the hands of a receiver. Perhaps the most striking part of the information presented is the rapid increase in electric mileage, which has increased from 365 miles of main line and branches within the state to 586 miles in a single year. The capitalization of these lines, however, has not increased at all proportionately. In 1903 the capital stock per mile of road stood at $171,836, and the funded debt per mile of road at $141,875, making a total capitalization per mile of $313,711. For 1904 this total capitalization had fallen to $222,615, a decrease which was, of course, due to the fact that the increase in mileage had been that of surface roads, while the figures mix the trolley lines of the open country with the Chicago elevated lines, which of necessity carry an extremely high capitalization. The average figure as given is therefore not only of no possible use, but is entirely misleading. The commission adds, however, in the form of a note, that for the year ending June 30, 1904, the average capitalization per mile of surface electric roads was $82,964, while for elevated roads it was $1,981,148. The same criticism of mixing returns from two radically different kinds of properties prevents any deductions of value from being made from the general income account, or from the traffic summaries. There was a very large increase in the number of revenue passengers carried in 1904 as compared with 1903, and a large decrease in the number per mile of road operated, occasioned by the fact, noted above, that the new mileage was chiefly that of thin trolley lines in the country, which increased the divisor for the number of passengers carried on the city elevated lines. At the present time of great expansion by electric lines it is unfortunate that the general totals are not separated, as they would be of considerable statistical interest.

The number of surface and elevated railways included in the report this year is 32. Of these, two are at present operated by receivers and five are building, or but newly completed. Five of the lines are elevated. The list excludes ordinary city traction lines, so that it is composed of a mixture of interurban lines and city elevated lines. The increase in mileage, therefore, is more significant from the standpoint of steam railroad competition than would be the case if city street lines were included. The greatest mileage operated by any electric line in the state is that of the Elgin, Aurora & Southern Traction Company, 60 miles. The Danville, Urbana & Champaign Company operates 59 miles, and the Aurora, Elgin & Chicago, 57. The total number of passengers killed on the electric railroads during the year was eight. Two employees were killed and 27 persons classified as "others," making a total of 37 killed. The total number injured was 490. The most prolific stated cause of accidents during the year on these roads was collision, although the total of three killed and 80 injured in this way is exceeded by the total of seven killed and 112 injured in unclassified train accidents, and of 20 killed and 151 injured in ways not included in the classification at all.

A return made to the House of Commons of the Canadian Parliaments shows that 322 railroad accidents occurred in Canada in the ten months ending Dec. 31, 1904.

English Gasolene Locomotives.

Several gasolene locomotives have recently been designed and built in England for use on mining and quarry roads, light junction railways, and tramways in large factories. There are many places where electric power is not available or where the trolley wires or third rails required for supplying the power are objectionable, and steam locomotives are too expensive to justify their use for the intermittent work required. The gasolene locomotive is peculiarly adapted for this work, as there is no expense for maintenance when it is not in operation, and it is always ready for service at a moment's notice.

The accompanying illustration, Fig. 1, shows a Wolseley light railway gasolene locomotive which is capable of hauling loads up to 15 tons at a speed of 10 miles an hour and is especially designed to start quickly. There is no visible exhaust, the running expenses are less, and the locomotive operates very quietly by utilizing an exhaust box or large-size muffler. One of the most desirable features in the utilization of an internal combustion engine for this class of work, of course, is the doing away with the necessity of keeping steam up on engines when not being used, as for light railway work where the service is irregular it is of importance not to be burning fuel when the engine is out of service. A locomotive of this type possesses many of the advantages of a light electric locomotive, while at the same time it requires no expensive permanent way, including electrical conductors and the installation of an electric power plant.

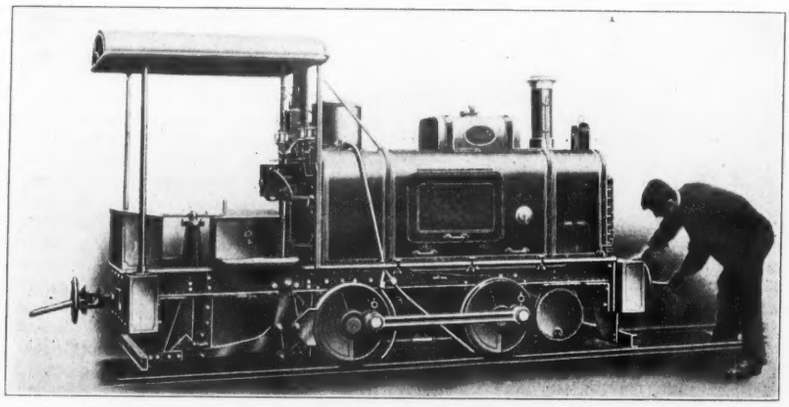


Fig. 1—Wolseley Gasolene Locomotive.

The locomotive shown in Fig. 1 was built by the Wolseley Tool & Motor Car Co., Ltd., of Adderley Park, Birmingham, England, for a 2-ft. 9½-in. gage, and similar engines have been built for other narrow gages. It is equipped with a horizontal gasolene engine operating at a speed of 600 r.p.m. and developing 20 brake horse power. The engine has two cylinders of 6-in. bore and 7-in. stroke, arranged side by side and connected with a heavy flywheel. The locomotive has four driving wheels coupled together, each wheel being 18 in. in diameter. The frame is of steel channels, consisting of two longitudinal and four transverse members braced together, the journal box pedestals being of malleable iron and bolted to the frame. The pedestals contain spring boxes for holding the spiral springs supporting the engine. A Renold silent chain is utilized as a drive from the gasolene engine, a chain wheel being mounted on the crank shaft of the engine and so arranged that by means of a conical friction clutch it can be thrown in and out of gear. Another Renold chain gear is fixed to the outer end of the first motion shaft in the change-speed gear-box, the latter being of special design supported by nose suspension on double bearings on the rear axle. This gear box provides two forward speeds and two reverse speeds of approximately 3 miles an hour and 8 miles an hour at normal engine speed. The change speed is effected by means of sliding gears and a positive clutch, the final reduction in the gear box being by ordinary spur wheels. A large ballast tank is provided instead of the ordinary cooler, and a high-speed pump on the engine keeps the cooling water circulating through this tank, while the action of the exhaust through the chimney also keeps a current of cold air circulating all around the engine, materially aiding in keeping the cylinder and other parts cool. The locomotive has electric ignition of the magneto, high-tension type, batteries not being recommended for this class of work. The gasolene tank has a capacity of ten gallons, which is sufficient for running the engine at full power for ten hours. The sand box is so arranged with piping that a circulation for warm water from the engine is carried around it to keep the sand dry, while hand actuated sand pipes are fitted to all four wheels. Each wheel is provided with a brake-shoe which is actuated from the engineer's seat by a wheel and screw arrangement, the brake shoes being of wood and easily adjusted or replaced when necessary. The locomotive weighs about 2.5 tons in working order with a full supply of fuel and water.

Another type of English gasolene locomotive is shown in Fig. 2. This locomotive was supplied to the City of London Corporation for use in the foreign cattle market at Deptford. It was built by the Maudslay Motor Co., Ltd., of Parkside, Coventry, and is used for hauling freight cars over a track that connects the London, Brighton & South Coast with the municipal market

The engine is very similar in appearance to the electric locomotives utilized for the same class of work, being fitted with Westinghouse as well as ordinary hand brakes. It is equipped with a three-cylinder, slow running engine developing 80 horse power at a normal speed of 450 r.p.m. The engine is of the vertical type, each of the three cylinders measuring 9 in. in diameter, with a stroke of 9 in. The locomotive is capable of handling a train of 50 tons on moderately heavy gradients without difficulty and it has two speeds in either direction. An auxiliary 8 h.p. engine installed on the locomotive is used for starting the main engine. There are duplicate sets of control levers fitted at both

ends of the cab and sanding apparatus is provided for all the wheels. Smaller locomotives of this type having a capacity as low as 14 b.h.p. have been designed for light work, as well as heavier locomotives with engines of 200 h.p. for use in severe service. Compression relief cams are provided on the main engine, which is turned over by the auxilliary single cylinder, 8 h.p. starting motor. The electric ignition is of the high tension type with accumulators and coil. The engine is water-cooled, with circulation through tubular radiators of large area, a fan system being also provided for aiding in cooling when operating at slow speed and under heavy loads. The fan is connected with the crank shaft and is found to materially assist the cooling when the locomotive runs at slow speed. The track on which the engine runs is standard gage and lies, in part, through the streets of the city. Trains of four cars having a weight of 100,000 lbs. are frequently hauled. This is the maximum load for the locomotive, which weighs about 24,000 lbs. Severe tests of this gasolene locomotive were made by the Board of Trade and it was found to give excellent service, stopping and starting under full load upon the heaviest grades and being under perfect control at all times. It is stated that the initial expense, all things considered, is much lower than electric locomotives, which require conductors and power station, while the cost of operation is considerably lower than with steam or electric locomotives having the same power.

Fig. 2—Maudslay Gasolene Locomotive.

Kansas Railroad Law.

At the recent session of the Legislature of the State of Kansas seven laws were enacted relating to railroads. The most important was the amendment to the general railway law of 1901. It provides for the election of the members of the Board of Railway Commissioners in the same manner that other state officers are elected instead of creating the board by appointment of the Governor; the Governor is to fill vacancies.

The new law provides for the appointment of an attorney by the Governor to appear before the board to prosecute complaints made against any railroad.

Members of the Board and its agents are to ride on all railroad trains while in the discharge of their duty, and it is unlawful for any person connected with the Board to ask or receive from any railroad free transportation or reduced rates. Other sections provide as follows: "Sec. 4.—Authority is vested in the Board to supervise all railroad freight and passenger rates, and all rules governing car service, the transfer of cars, and the rules for the running of trains. It shall be the duty of the Board, from time to time, to alter any schedule, classification, rate, rule or regulation which the board, upon complaint, may find to be unreasonable, unjust, or discriminative; and such amended schedule, etc., shall be put into effect within 30 days provided, that before such order is made by the Board, notice and a hearing shall be given as required in section 9.

Where connecting lines fail to agree on the division of charges the board shall divide. The board is required to investigate interstate freight rates, and when found excessive, to request and notify the road to reduce the rates; if not changed the Board is to notify the Interstate Commerce Commission and apply for relief.

All railroads are required to furnish the board with copies of all tariffs; all divisions of rates; all rules regarding switching; all orders providing for mileage, per diem, demurrage or storage charges for use of cars loaded or empty, and of rules governing the action of employees in operating trains.

Section 9 is the portion of the bill over which the strongest fight occurred, and is a compromise. The principal fight was on a clause which provided that the Board should "upon their own motion" investigate alleged discriminations, etc. The Senate finally won and the attorney for the Board is to have power to make complaint to the board as well as any other person, and the board may act only upon formal complaints.

Section 9, after providing for receiving complaints, notifying carriers, etc., says: When a complaint has been made which involves general rates or classification, or general rates on certain commodities, the commissioners shall investigate and determine all matters so involved without regard to the subsequent action of the complainant or the withdrawal of the complaint. And whenever the board shall decide what is a reasonable charge for any freights, based on the classification existing at the time of such decision, such rates and classification and all rates and classifications now in effect shall not be altered thereafter without the consent of the board, so as in effect to increase such charge as to any class of goods, but such decision as to what is a reasonable charge shall be determined according to the classification existing when the decision was made. If any railroad company shall make, charge or receive from any shipper a less rate for the transportation of freight than the rate authorized by the Board of Railroad Commissioners, it shall make the same lesser rate to all persons for like contemporaneous services in the transportation of like kinds of freight under substantially similar circumstances and conditions. Where a rate duly declared reasonable, and rates above it are charged, then the railroad shall repay the amount so charged or received in excess on demand therefor; and in case of failure to repay within 30 days the amount thereof may be recovered, together with reasonable attorney fees, in an action brought for that purpose in any court of competent jurisdiction; provided, that if such railroad company shall, within 30 days after such decision or determination by said Board, bring suit to test the reasonableness of such rates, no suit shall be brought for said excess until said rates have been adjudicated."

Witnesses may be compelled to attend hearings of the Board, etc., and to testify.

Sec. 13.—"It shall be unlawful for any railroad to change the classification of its freights, or to raise charges without having first obtained an order from the commissioners; provided, that nothing in this act shall be construed to prevent the railroads, with the consent of said commissioners, from declaring and making emergency rates for a limited time."

In regard to rebates section 16 provides: "It shall be unlawful for any railroad company or other common carrier to grant, or for any consignee or consignor to receive, any rebate or drawback, or enter into any arrangement whereby such consignee or consignor shall, directly or indirectly, receive a lower rate, etc."

The Board is given power to examine any of the books, papers, documents or records of any railroad. The Board shall notify the company of changes or improvements they deem proper, and if the notice is not complied with action may be begun to compel.

Any person is given authority to condemn and appropriate land to the same extent now enjoyed by railroads for the purpose of connecting private sidings to any railroad track, and may connect the same with any railroad. The Board may order track connections between two roads at any point where it is deemed wise, and the cost of construction shall be borne equally between the two roads.

Automatic signals and interlocking plants may be established and trains run over crossings without stopping, under the supervision of the Board.

Maximum passenger rates of three cents a mile are provided for, with the customary number of pounds of baggage.

The law is intended to prevent the pooling of freights and the division of earnings. It is made unlawful to charge more to haul any class of freight for a certain distance than is charged for the same service for a longer distance.

No railroad is permitted except by permission of the Board to change or limit its common-law liability as a common carrier.

Reports containing comprehensive statements from the railroads are required.

A law concerning the furnishing of cars to shippers provides:

That any railroad company must furnish suitable cars to any and all persons who shall apply therefor in good faith, without discrimination, and that freight shall be transported with reasonable despatch, and that loaded or empty cars to or from connecting lines shall be handled promptly, and

that in compensation it shall not demand or receive a greater sum than is accepted by it from any other connecting line for such service.

That when any shipper of any freight shall make application in writing to the railroad for cars they shall be supplied at the point designated by the shipper within a reasonable time thereafter not exceeding six days from the date of the application, and that cars shall be delivered to the person or persons applying in the order in which the applications are made without preference; provided, that if the application be for ten cars or less the same shall be furnished in three days, and if the application be for 30 cars or more, the company may have 10 full days to supply them.

That if cars are not furnished as required by law the company shall be liable to the person making application in the sum of one dollar per day for each car not furnished, and the actual damages sustained by the shipper.

That the shipper shall deposit with the railroad at the time of making application for cars a sum amounting to one-quarter of the total freight charges, unless the railroad will agree to furnish the cars without the deposit. The shipper is given 48 hours to load the cars, and shall be liable to the company in the sum of one dollar a day for each car not loaded in that time.

Shipments must be moved forward at a rate of not less than 50 miles a day except Sundays, but the law does not authorize that to be a proper or legal rate of speed for transportation of live stock or perishable freight, nor release the railroads from liability for failure to handle such shipments at a reasonable rate of speed. Penalties are provided for any delay which is found to be unreasonable.

Railroad companies are required to notify consignee of the fact that cars are ready to be unloaded.

An act which will no doubt sooner or later be brought to the attention of the Supreme Court on a question of its validity is that declaring oil pipe lines common carriers, and as such prescribing rates and placing them under the jurisdiction of the Board of Railway Commissioners. It is believed in Kansas that the Standard Oil Company will carry the matter to the courts. The law provides that pipe line companies or any firm, corporation, etc., operating a pipe line shall establish and maintain receptacles for receiving oil for transportation, and also for storage at the point of delivery a reasonable length of time till it be removed by the consignee. The manner of payment for shipment is prescribed and the pipe-line company must furnish shippers with receipts and statements of the quantity and specific gravity of all shipments.

Section 3 of the law provides maximum rates for such service, and the law also gives the commissioners power to establish other maximum rates not higher than those prescribed in the law, if the Board deems it advisable. The law makes it unlawful to charge in excess of the following schedule for the transportation of each barrel of 42 gallons: Six miles and less, 5 cents; over six miles and not more than 15 miles, 6 cents; over 100 miles and not more than 150 miles, 15 cents; over 200 miles and not more than 250 miles, 23 cents; over 250 miles and not more than 300 miles, 25 cents.

If the Board decides to order lower rates then the pipe line companies have the privilege of appealing to a proper court provided a bond is given to the State of Kansas to pay the difference to all shippers between the rate collected and the rate finally ordered by the court.

The law provides a penalty if any pipe line company refuses to transport oil offered to it for shipment, and provides for liquidated damages in the sum of $500 for each complaint, with costs of attorney's fees.

Another law fixes maximum rates for the transportation of oil in cans, barrels, tanks or tank-cars as follows, per 100 lbs. (other zones in proportion):

Distance, miles.	Single-line rates.	Double-line rates.
6 and less	2.5 cts.	4.0 cts.
10 and over 6	3 "	4.5 "
100 " 80	7 "	8.5 "
250 " 225	10 "	10.5 "
Over 250	10.5 "	10.5 "

The railroads have adopted the rates named in the law, which are but about one-third the former rates, and thus far have offered no objection.

By another act of the legislature the Board is empowered to prescribe rules for regulating the stringing of wires, electric or otherwise, over or under railroad tracks, and to supervise the support, maintenance, repairing or reconstruction thereof. The Board has held a meeting with representatives of the railroad and telegraph and telephone companies and the following regulations have been mutually agreed upon:

1. All poles sustaining wires which cross railroad tracks shall be of sound timber not less than 6 in. through at the top, placed 6 ft. or more in the ground, and the wires shall be 25 ft. above the tracks.

2. All poles shall be located not less than 10 ft. nor more than 52 ft. from the tracks.

3. All wires shall cross tracks at right angles.

4. When wires are placed under the tracks they shall be buried at least three feet.

5. All telegraph and telephone and light and power companies, etc., must comply with the rules at once.

The object is to protect trainmen on the top of trains.

Two laws relating to side tracks to elevators, etc., were passed. One provides that any person or corporation desirous of erecting or who has erected a grain elevator of not less than 10,000 bushels' storage capacity, or flouring mill of not less than 50 barrels per 24 hours on land adjacent to the right of way or within one-fourth of a mile of any way station shall have the right to demand of the railroad company that it designate the location of a side track from the site of the industry which it will agree to construct and connect with a switch with any side track of the railroad, and that it designate the terms and conditions upon which it will construct, maintain and operate the side track. The demand must be made to the railway in writing and must be accompanied by a deposit of $25 as a payment on the amount of compensation the company shall become entitled to and which shall be forfeited if the party asking for the side track withdraws the request. The notice of demand for track may be filed with the agent at the point where the side track is desired.

If the party desiring the track and the railroad company cannot come to a mutual agreement in regard to the matters in connection with the installation of a side-track, the Board of Railway Commissioners are empowered to settle the controversy. When matters are adjusted or ordered by the Board the railroad must at once construct the side track; and it will at all times be under the control and management of the road and the repairs must be made by the road. The Board is empowered to designate a location for a side track if it cannot be agreed upon.

The law also provides that if the railroad so desires it may designate a suitable location on its right of way adjacent to its side tracks and permit the erection of the mill or elevator on the right of way rather than to build a side track to the industry at a distance from the main line.

If it cannot be mutually agreed what the compensation shall be to the railroad company for this privilege it shall be determined by the Board of Commissioners.

The other law relating to these matters provides that if the railroad company refuses to grant the demands of any party for a site for an industry or a side track to the industry, the Board may investigate and order the railroad company to comply with the demand, provided that the railroad shall not be compelled to build a track off of property owned by the company, but that it may be compelled to build to the boundary of the right of way and there connect with the track of the owner of the industry.

Train Accidents in the United States in April.[1]

unf, 1st, New York Central & Hudson River, St. Johnsville, N. Y., eastbound passenger train No. 8 (on the West Shore road) was derailed, and the engine fell off the roadbed and dropped perpendicularly 40 ft. into the canal below. The engineman and fireman were killed and the express messenger was injured.

bc, 2d, 4 a.m., Southern Railway, Branchville, S. C., butting collision between a westbound passenger train and an eastbound freight train. Both enginemen and both firemen killed and a fifth trainman injured. There was a dense fog at the time.

The Columbia *State*, reporting the hearing before the State Railroad Commission, gives the following particulars of this collision:

"According to the evidence, the crew had been on duty 40 hours without sleep and 29 hours and 40 minutes without a meal—without even a sandwich.

"Freight train No. 155 left Rock Hill at 2.45 on the afternoon of March 31; the crew had been called at 12 o'clock. The train reached Camden at 3 a.m. After shifting at Camden for three hours the train was delayed on account of being run into by a train of the Northwestern railroad, which necessitated quite a long wait. It was 5.05 a.m., April 1, before the train reached Kingville, after having been out from Rock Hill over 24 hours, and the crew had been on duty 29 hours.

"At Kingville the members of the crew first got something to eat. They were asked by the train dispatcher at Charleston, if they felt like taking the train on to Charleston. As it was Saturday afternoon and they wanted to spend Sunday in Charleston, and as the train had been delayed many hours already and their declining to take it into Charleston might cause the freight to lie over until Monday morning at Kingville, the crew decided to go on with it. At Kingville they got something to eat for the first time since leaving Rock Hill. But it was not until 11 p.m. that the train pulled out of Kingville.

"Arriving at Orangeburg, the members of

[1] Accidents in which injuries are few or slight and the money loss is apparently small, will as a rule be omitted from this list. The official accident record published by the Interstate Commerce Commission quarterly is regularly reprinted in *The Railroad Gazette*. The classification of the accidents in the present list is indicated by the use of the following:

ABBREVIATIONS.

rc	Rear collisions.
bc	Butting collision.
xc	Miscellaneous collisions.
dr	Derailments; defects of roadway.
eq	Derailments; defect of equipment.
dn	Derailments; negligence in operating.
unf	Derailments; unforeseen obstruction.
unx	Derailments; unexplained.
o	Miscellaneous accidents.

An asterisk at the beginning of a paragraph indicates a wreck wholly or partly destroyed by fire; a dagger indicates an accident causing the death of one or more passengers.

the crew were asked by the operator at that office if they could go on to Charleston, and they replied that they would. This was also the answer to the inquiry from the operator at Branchville. When the latter operator asked the conductor where he would pass the passenger train, the latter replied at St. George, he thought.

The collision with westbound passenger No. 15, occurred one and one-half miles west of St. George, between 4.30 and 4.40 a.m.

"According to the conductor, when the freight struck the switch at Reevesville and went on by, he looked at his watch and saw that even if the passenger were five minutes late the freight could not make Badham, which is a mile west of St. George. Accordingly he sprang out of the cab to signal the engineer. There were 39 cars on the train, and the two last were not supplied with air-brakes. When he had climbed over these he came upon a flat car loaded with all kinds of debris, and before he could pick his way over the car the collision came. It was a foggy morning.

"Engineer Reed, of the freight, did not die immediately, and before death admitted that his watch was half an hour slow. No doubt he thought he had plenty of time to make St. George when he looked at his watch.

"Conductor Stanley and Engineer Reed compared watches at Kingville, and there was but ten seconds' difference in the time. But when the conductor went to the dying engineer and looked at his watch he saw that it was half an hour slow. There is no way to account for this except that the watch stopped in the engineer's pocket, and he was too tired to observe it, but afterwards wound it mechanically without looking at the face."

bc, 2d, Atchison, Topeka & Santa Fe, Raton, N. M., butting collision between a freight train and a work train; two employees killed and four injured, two of them fatally.

unx, 3d, 9 p.m., Lehigh Valley, Caywood, N. Y., a truck of a car in a westbound freight train was derailed and ran partly across the eastbound track; it was struck by eastbound passenger train No. 20, and the passenger engine was overturned. The engineman was killed.

bc, 4th, Pennsylvania lines, Castoria, Ohio, butting collision between a passenger train and a freight; engineman and fireman killed, and baggageman and three passengers injured. It is said that the freight had just entered a side track, and, the speed not being properly controlled, it ran out on to the main track at the out-going end.

bc, 6th, Baltimore & Ohio, Bethseda, Ohio, butting collision between an eastbound passenger train and a westbound freight. The passenger engineman was killed and three other trainmen and two passengers were injured.

xc, 6th, 4 a.m., Cincinnati, Hamilton & Dayton, Indianapolis, Ind., a freight engine which had escaped control in a yard, ran about two miles on the main line and collided with a switching engine of the Lake Erie & Western, near the union station; three employees injured.

xc, 8th, Southern Railway, Chattanooga, Tenn., collision between a freight train and a work train, wrecking two engines and six cars; four trainmen injured.

o, 8th, Mobile & Ohio, Artesia, Miss., a switching locomotive was wrecked by the explosion of its boiler; engineman killed, two other trainmen injured.

unf, 9th, Southern Railway, Front Royal, Va., a freight train was derailed by running over a steer, and the fireman was killed.

*rc, 10th, 10 p.m., Atchison, Topeka & Santa Fe, Kinsley, Kan., eastbound passenger train No. 8, standing at the station, was run into at the rear by following passenger train, No. 4, and the rear car of the standing train, which was empty, was wrecked. The wreck took fire and was partly burnt up. Ten passengers and four trainmen were injured.

o, 10th, Northern Pacific, Belgrade, Mont., the locomotive of a freight train was wrecked by the explosion of its boiler; engineman killed, five trainmen and one drover injured.

dn, 11th, 4 a.m., Louisville & Nashville, Lynville, Tenn., passenger train No. 1 was derailed at a misplaced switch, making a bad wreck. The engine and first two cars were ditched and the main car fell down a bank; four trainmen injured.

dn, 12th, Cleveland, Cincinnati, Chicago & St. Louis, Bellefontaine, Ohio, westbound passenger train No. 43 was derailed at the crossing of the Ohio Central and three trainmen were injured. The train was derailed because it approached the crossing at excessive speed in consequence of the failure of the engineman to keep his air-brake pipeline charged, and to test the brakes while running.

unf, 12th, 11 p.m., Yazoo & Mississippi Valley, Walsh, Miss., a passenger train was derailed at a switch which is said to have been maliciously misplaced, and the engine was overturned. Five passengers and four trainmen were injured.

xc, 13th, Southern Railway, Columbus, Ga., three freight cars which had escaped control, ran at high speed to the crossing of the Central of Georgia and collided with a train of the latter road. One car in the Central train was knocked over and fell upon three girls standing near the track; one of the girls was killed and the other two injured.

bc, 15th, Atlantic Coast Line, Ashley Junction, S. C., butting collision between a freight train and an empty engine. One trainman jumped off and was killed.

dr, 15th, Tennessee Central, Hickman, Tenn., a passenger train was derailed by defective track and two passenger cars were overturned. Six passengers were injured.

dr, 15th, Missouri Pacific, Sedalia, Mo., passenger train No. 3 was derailed at a switch and the engineman was killed.

bc, 16th, Erie road, North Tonawanda, N. Y., butting collision of freight trains; two trainmen were killed.

unx, 16th, Chicago, Rock Island & Pacific, Bland, Mo., westbound passenger train No. 1 was derailed and the first three cars were overturned. The fireman was injured.

*unx, 17th, Central of Georgia, Ellaville, Ga., the caboose of a freight train was derailed and overturned, caught fire and was destroyed. Two trainmen were injured.

unx, 17th, New York, New Haven & Hartford, Ridgefield, Conn., a passenger train consisting of a locomotive and two cars, the locomotive running tender first, was derailed and the engine was overturned. The engineman was killed and the fireman injured.

dr, 18th, 11 p.m., Canadian Pacific, Bancroft, Me., a passenger train was derailed at a point where the roadbed had been weakened, and two cars were overturned. Two passengers were injured.

†dr, 19th, Illinois Central, Vine Grove, Ky., 14 cars of a freight train were derailed by spreading of rails and fell down a bank. A passenger riding in the caboose was fatally injured.

xc, 19th, Mobile & Ohio, Mobile, Ala., a locomotive ran over a misplaced switch and collided with some freight cars standing on the side track. The engineman was killed and four other employees were injured.

xc, 20th, Missouri, Kansas & Texas, Bruceville, Tex., a freight train backing into a side track was run into by a following fast freight, and one engine and several cars of cattle were wrecked. One fireman was killed and two other trainmen were injured, one of them fatally.

eq, 20th, Mississippi Central, Hattiesburg, Miss., a passenger train was derailed on a trestle bridge and two passenger cars fell to the ravine below, about 15 feet, being overturned in the fall. The number of passengers injured is reported as eight, though the coaches are said to have been well filled. It is said that the derailment was due to the breaking of an axle of the tender.

unf, 20th, Southern Railway, Rome, Ga., the first section of the Chicago express, consisting of baggage and mail cars, was derailed on a trestle bridge which had been weakened by fire, and several trainmen were injured. The engine passed over the bridge in safety.

xc, 21st, Chicago, Rock Island & Pacific, Lincoln, Neb., westbound passenger train No. 5 collided with a switching freight train, wrecking both engines and several cars. Ten passengers were injured. It is said that the collision was due to a misplaced switch.

unx, 21st, Vicksburg, Shreveport & Pacific, Haughton, La., a freight train was derailed and 12 cars were wrecked. Two tramps were killed.

unf, 22d, Union Pacific, Edson, Wyo., a freight train was derailed by running into a landslide and the engine and several cars were badly damaged. The engineman, fireman and one brakeman were caught in the wreck and were buried alive by a further slide, which occurred after the cars had been derailed. The rear portion of the train, when stopped, was in a tunnel 1,000 ft. long, and the landslide completely choked the mouth of the tunnel. Besides the three trainmen mentioned, one tramp was killed.

xc, 23d, Cleveland, Cincinnati, Chicago & St. Louis, Mattoon, Ill., collision of locomotives; one engineman killed, one fireman fatally injured.

dn, 23d, Cleveland, Cincinnati, Chicago & St. Louis, North Indianapolis, Ind., a freight train was derailed while running through a curve at the junction of the Belt Railroad, apparently because running too fast, and the engine was overturned. Four cars of rails and two other cars were wrecked. The engineman and one brakeman were killed and two other trainmen were injured.

unf, 24th, Yazoo & Mississippi Valley, Marigold, Miss., a freight train was derailed by running over a cow and the engine was overturned. Engineman O'Leary was fatally scalded.

unf, 25th, 4 a.m., Chicago, Rock Island & Pacific, Jefferson, Okla., a freight train was derailed by running over a cow and 14 cars were ditched. The engineman was killed. It is said that the derailment occurred on a side track and that the presence of the train on the side track was due to the malicious misplacement of a switch. The switchlight had been extinguished.

unf, 25th, Atchison, Topeka & Santa Fe, Ash Fork, Ariz., an eastbound passenger train was derailed at a point where the roadbed had been softened by rain, and the engine was overturned. The engineman and fireman were killed.

*unf, 25th, Chesapeake & Ohio, Cass, Va., a passenger train was derailed by a tree which had fallen upon the track, and the entire train, consisting of an engine and two cars, fell to the river, 30 feet below. A brakeman, riding on the engine, was killed and the engineman, fireman and six passengers were injured. The wrecked cars took fire from the lamps and were burnt up.

unf, 25th, 8 p.m., Baltimore & Ohio Southwestern, Caseyville, Ill., freight train No. 98 was derailed by running into a washout and the engine was overturned. The engineman was killed.

dn, 26th, Erie road, Marion, Ohio, westbound passenger train No. 21 was derailed at a derailing switch while running about 20 miles an hour, and six passengers and four trainmen were injured. The engine and first two cars were overturned.

xc, 27th, Northern Central, York, Pa., a passenger train ran over a misplaced switch and into some freight cars on the side track, badly damaging the engine. Five passengers were injured.

xc, 29th, Southern Railway, Greenville, S. C., a special passenger train collided with a switching freight train and the baggage car and two dining cars of the special train were wrecked. The wreck took fire and the dining cars were burnt up. One fireman and three employees of the dining car were killed and three other trainmen and four passengers were injured.

unf, 30th, 1 a. m., Atchison, Topeka & Santa Fe, Brookeland, Tex., a freight train was derailed by running into a washout, and several cars of cattle were wrecked. Of the four men on the two engines drawing the train, two were killed and the other two injured.

unx, 30th, Houston & Texas Central, Hearne, Tex., a freight train was derailed and wrecked and two trainmen were killed.

Philippine Railroads.

The principal provisions relating to railroads in the act recently passed by Congress and signed by the President for the Philippine Islands are as follows: The Philippine Government is empowered to enter into a contract with any railroad company organized under its laws or under the laws of the United States, or of any state in the United States, which undertakes to build, equip, operate and maintain a railroad in the Philippine Islands to guarantee interest at not exceeding 4 per cent. per annum on first lien bonds to be issued by such company properly secured by mortgage. The total amount of bonds upon which interest is to be guaranteed shall in no event exceed the amount actually invested in cash in the building and equipment of the railroad. No debt shall be incurred by the railroad company by which a lien shall be created upon its railroad, equipment or other property prior to the lien of the Philippine Government to secure the repayment of interest paid by it under the guarantee. The railroad shall be built and equipped within the time limited in the first instance by the Philippine Government, or any extension of time granted by the Government for a good cause. After the railroad is in operation, its gross earnings shall be applied as follows: First, to necessary operating expenses including reasonable expenses of the corporation; second, to necessary and ordinary repairs of the railroad and equipment; third, to such betterments and extraordinary repairs as may be first expressly consented to in writing by the Governor-General of the Islands, and fourth, to the payment of interest on the bonds, interest on which, to any extent, shall have been guaranteed by the Government. The contract of guaranty shall not be executed except upon satisfactory proof of the completion of the railroad in sections of not less than 20 continuous miles each, and in such proportion to be fixed by the Government as the actual capital invested in the part of the road which is completed, with equipment, shall bear to the capital required for the completion and equipment of the entire road. All payments made under such guarantees shall be from the time of payment a lien upon the railroad and all its property then owned or thereafter acquired, subject only to the lien of the mortgage securing the guaranteed bonds, and the total sum paid under such guarantee shall, at its expiration, be payable to the Government on demand, and in default of such payment, the lien shall be immediately foreclosed. In no case shall the total annual contingent liability of the Philippine Government under the guarantees exceed the sum of $1,200,000, and no guarantee shall last for longer than 30 years. The Government shall declare the proper rules for ascertaining the cash capital actually invested, and the net income actually received, and shall provide for supervision through its auditing, engineering and railroad bureaus, of the conduct of the finances of the road, and of its location, construction, operation and maintenance. It shall also appoint two members of the Board of Directors of any company whose bonds are guaranteed. Every company shall make such reports as to receipts and expenditures as may be prescribed by the Government. The Supreme Court of the Philippine Islands shall have original and exclusive jurisdiction in all actions brought by the Philippine Government against any person or corporation in connection with the provisions of this law. Material imported into the Philippine Islands for the building and equipment of railroads therein, may, in the discretion of the general Government of the Islands, be admitted free of duty.

The report of the Bureau of Insular Affairs describes eight proposed lines in the Philippine Islands; four on the Island of Luzon, and one each in Panay, Negros, Lyte and Cebu. The three most important lines in Luzon were described in our issue of Nov. 27, 1903, page 842. These are: (1) From Manila to Aparri, on the north coast of the island, 336 miles. (2) From Dagupan, the present northern terminus of the Manila & Dagupan Railroad, north along the west coast to Laoag, 168 miles. (3) From Manila south to Batangas, 60 miles. The fourth line proposed in Luzon is to run from Pasaco, on the west coast of the Province of Ambos Camarines, northeast to Neuva Caceres, thence southeast to Ligao, in the Province of Albay, with two extensions from Ligao, one to the port of Tabaco and the other to the port of Legaspi. This line would run through the great hemp region of Luzon and pass through towns which have an aggregate population of 182,720. Besides these four lines on the Island of Luzon, a branch line is projected from Dagupan to Baguio, in the province of Benguet, 55 miles.

A line is proposed on the Island of Panay, which has a population of 743,646, from Capiz, on the north coast to Iloilo, on the south coast. On the island of Negros, a line is proposed from Escalante, on the northeast coast, across the island and down the west coast, from 100 to 150 miles. This line would pass through towns having a population of 184,889. On the island of Leyte, a line is proposed from Tacloban, on the northeast coast, northwest to Carigara, 30 miles. The line proposed on the island of Cebu is to run from Danao, on the east coast, southwest across the island to Dumanjug (Dumanjok), 55 miles, with 156,632 tributary population.

A Graphic Method of Calculating Overhaul.

BY PAUL STERLING.
Assistant Engineer, N. Y., N. H. & H.

Of the many points of contention between contractors and engineers there is none more difficult to satisfactorily adjust than the allowance for quantities of overhaul. On account of the irregularities of the original surface, calculating the exact centers of gravity of the cut and of the fill is practically impossible, and the result usually obtained is largely a matter of guess work.

The accompanying diagram shows a graphic method of figuring overhaul which is simple and quite satisfactory to the contractor and engineer alike, the writer having used this method in actual work for a number of years. The cross-sections should first be calculated in the usual way, making a tabulation of stations, distances, areas, average areas and volumes between each station in cubic feet or cubic yards for the cut and for the fill. An additional integrating column of volumes, that is, the total number of cubic feet up to each station should also be included. Such a table would be as follows:

Station No.	Distance.	Area.	Average area.	Volume, cu. ft.	Integrating column.
930	0	0	...	.....	.....
931	100	212	106	10,600	10,600
932	100	262	237	23,700	34,300
933	100	230	246	24,600	58,900
934	100	190	210	21,000	79,900
935	100	208	199	19,900	99,800

In computing quantities in cuts and fills from cross-sections, the quantity in the cut is seldom found to be the same as the quantity in the fill, so that in the tabulation of quantities in the fill it will usually be necessary to make still another column, in which the proper percentage of each of the several items in the integrating column is calculated, so as to make the total cubic feet in the fill equal the total cubic feet in the cut.

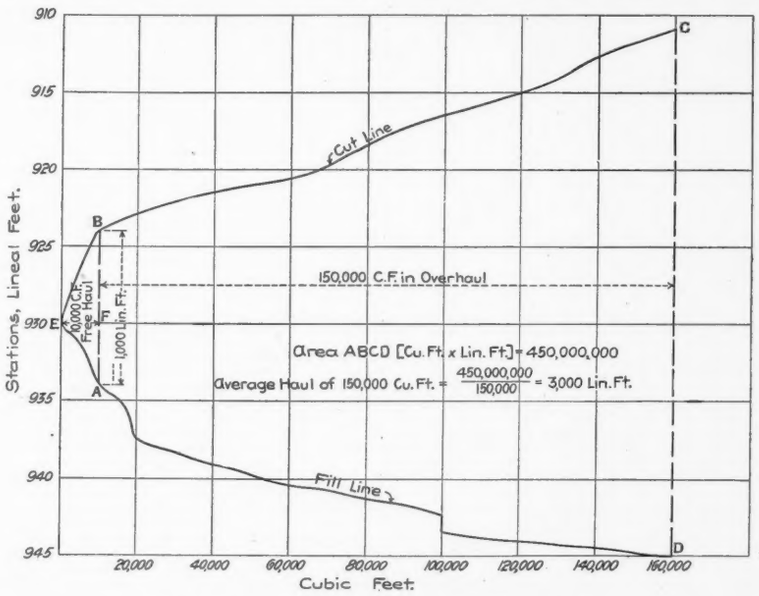


Diagram for Calculating Amount of Overhaul.

Referring now to the diagram, the vertical scale is linear feet and the horizontal scale is cubic feet. It is required to find the overhaul for a cut containing 160,000 cu. ft. which made (taking a suitable percentage) a fill of 160,000 cu. ft. A free haul of 1,000 it is to be allowed. Plot the figure E B C D A E to the correct scale from the integrating columns of the tabulated quantities in the cut and fill. Measure the distance A B equal to 1,000 ft. or the amount of free haul and then scale the distance E F. Suppose in this case E F equals 10,000 cu. ft., which is the quantity in the free haul. Subtracting this from the total of 160,000 cu. ft. leaves 150,000 cu. ft. in the overhaul. Now scale the area A B C D, remembering that the vertical scale is linear feet and the horizontal scale is cubic feeet. Assume this area to be equal to 450,000,000. Divide this by 150,000 cu. ft. and the result is 3,000 linear feet. That is, 150,000 cu. ft. must be hauled 3,000 linear feet. Subtracting the free haul of 1,000 ft., the final basis of payment would be 150,000 cu. ft. hauled 2,000 ft.

GENERAL NEWS SECTION

NOTES.

On the "Diamond special" night express trains of the Illinois Central between Chicago and St. Louis cafe cars are now run, on which meals are served at any time of night.

On May 23 the Senate Committee finished taking testimony with regard to rate regulation. The opposition to commission-regulated rates has been very strongly brought out since the adjournment of Congress, and the testimony of large shippers who favored the present system as opposed to President Roosevelt's plan, was especially convincing.

The National Association of Manufacturers at its annual meeting in Atlanta, Ga., last week passed resolutions favoring strict enforcement of existing laws regarding railroad rates and favoring legislation for examination of books of railroads and corporations looking to elimination of discriminations, but did not take any action favoring the vesting of rate-making powers in the national Government.

The permanent commission of the International Railway Congress at its meeting on the last day of the Washington session re-elected the old officers and elected five new members from America, namely, Paul Morton, Secretary of the Navy; Samuel Spencer, President of the Southern Railway; George W. Stevens, President of the Chesapeake & Ohio; Charles M. Hays, President of the Grand Trunk, and Frank Barr, Vice-President of the Boston & Maine.

Beginning May 28 several passenger crews of the Pennsylvania Railroad, on the New York and Washington trains that now change at West Philadelphia in both directions, will begin running through, 225 miles. There will be seven crews from the Maryland division of the Philadelphia, Baltimore & Washington, and five from the New York division. At the conclusion of a round trip a crew will lie off a day.

On May 2 the Pennsylvania began the experiment of running fast freight trains through between Jersey City and Harrisburg via Mantua, with one crew, pilots being employed where necessary until the enginemen become familiar with the whole road. The distance is about 192 miles. Two Jersey City crews were put on and are running on alternate days. The schedule allowance is 12 hours, and the round trip is accomplished in one day, after which the crew lies off two days. Some of the runs have been made in about seven hours and all of them within the schedule limit. The plan has proved so satisfactory to both the company and men that two more Jersey City crews were put on the run May 15.

Experiment in Rational Fare Collection.

The Montreal Street Railway is now using, experimentally, a street car designed to insure the collection of fare from every passenger who enters it. The officers of the company estimate that in the rush hours at least one-fifth of the passengers get off without paying. The new car has a rear platform 7 ft. long and the rear end of the car has two doors, one for passengers entering and one for those going out. Passengers are allowed to go out also by the front door. The rear platform is divided by a railing, so that only a small portion of it is used by outgoing passengers, and the exit door opens outward in such a way that passengers cannot enter that way. In case of a rush, 20 passengers can stand on the rear platform at one time, and the conductor, standing at the doorway, can collect their fares as they pass to the inside of the car. The conductor is to be at the rear of the car at all times. The exit door at the front can be opened by the motorman by means of a lever which he presses with his foot.

New Automatic Signals.

The General Railway Signal Company, which has not hitherto been prominent in automatic signal work, has taken contracts to furnish 45 automatic block signals for the Union Pacific and 16 for the Illinois Central.

Hamburg-American Report.

The report of the Hamburg-American Steamship Company for 1904 shows a highly prosperous year's business. The net profits amount to $6,623,474 ($4,833,405 in 1903), after having paid the interest on its bonded debt, an increase as compared with 1903 of $1,790,000. These earnings do not include the very considerable profit made by selling a number of steamships to the Russian Government. The company now owns 149 ocean steamships and 182 smaller vessels. Their total capacity is 764,551 gross tons, exceeding that of 1903 by 36,000 tons. These vessels run on 46 routes, and the company has a controlling interest in six foreign shipping lines. The company is extending its business in all directions over the world. It has established pleasure excursion lines which make trips to South America, to the North Cape, around the Mediterranean, and around the world. These ocean excursion lines are very popular, are well patronized by tourists from America and Europe, and pay well. The company has started a "sanitary steamship excursion" which is to benefit invalids by sea voyages, and it is about to run a fleet of steamers for touring the Nile. It has organized a special bureau for "tourist excursions" which will rival Cook's.—*Consular Report.*

Steam Motor Cars in Ireland.

The Belfast and County Down Railroad is trying the experiment of using steam motor cars for its suburban service out of Belfast, and two of the new cars have just been delivered by the builders. The length of each is 63 ft. over all, the car section being 45 ft. long. The front end is supported by the locomotive and the rear end by a four-wheel bogie of the usual type. The engine is supported on four driving wheels and has two cylinders, each 10 in. in diameter, and 16-in. stroke. The boiler is of ordinary locomotive pattern with 9¾ sq. ft. of grate area and 505 sq. ft. of heating surface in firebox and tubes. The working steam pressure will be 160 lbs., and the engine is powerful enough to handle the car and a trailer. The total weight of car and engine is 40 tons. The car proper is of the ordinary American corridor type, with seats for 48 passengers, who will enter and leave by the rear platform. These cars will be put into service between Belfast and Holywood, a seaside suburb four miles distant, making five intermediate stops. If these experimental cars prove successful the service will be extended as far as is practicable on the two lines of the company. This is the first experiment of the kind in the north of Ireland.—*Consular Reports.*

Indian Railroad Finance.

The announcement by the Secretary of State for India that on December 31, he intends to take over the Bombay, Baroda and Central India Railroad, marks a further important stage in the process by which the railroads of India are becoming the property of the Indian Government. It is true that the Indian Government has, for good reasons, handed over, under lease, the working of most of the lines to the companies which built and operated them during the periods of their respective concessions; but all the lines are, or will be shortly, the property of the Government. In April, 1907, the Government can take over the Madras Railroad, and the Southern Mahratta in June of that year. One result of the present state of things is that neither the Government nor the companies can make as effective a use of the assets represented by the lines as their value should make possible. The estimated net receipts from the working of railroads in India during 1904-5 were approximately $63,180,000. This figure at 4 per cent. would give a capitalized value of $1,579,500,000 for the railroad property. Out of the total, something less than a third is now the absolute property of Government, but no use is made of it as a special security on which to raise funds for further railroad development. The remainder is in the hands of companies whose interests are limited to working leases, and, therefore, in their financial transactions, they are not in a position to profit by the full value of the security which they control. At present the value of the railroad property held by the Government is merged in the general assets of India on which the Government raises its annual loans, but the credit of India is so good that the withdrawal of that property from among the securities today forming part of these general assets would not affect the success of these comparatively small loan transactions; and if ordinary debenture stock were issued on the railroad property, which is worth over $1,458,000,000, it would probably be a matter of ease to raise $48,600,000 to $58,320,000 yearly for several years to come. If the course suggested were adopted, the Government of India might reserve borrowing, on the security of its general credit, for cases of emergency, and get the money needed for railroad development on the security of railroad property. Of course some modification of the existing arrangements would be necessary as regards the leased lines. The companies which work them would have to be placed in a position to make full use of the assets leased to them. This might be done by reconstituting the companies as corporations of

which the capital would be held entirely by the Indian Government and whose status would be that of an independent company with the usual borrowing powers.—*London Times.*

British Standard Rail Sections.

The sub-committee of the Engineering Standards Committee which was appointed in 1901 under the chairmanship of Mr. James C. Inglis, of the Great Western Railway, to draft standard specifications for bull-head and flat-bottom rails, has completed its work by the publication of a standard set of specifications for flat-bottom rails covering 17 weights from 20 lbs. to 100 lbs. per yard.* The specifications for bull-head rails were published last October and include nine weights of rail from 60 lbs. to 100 lbs. per yard.

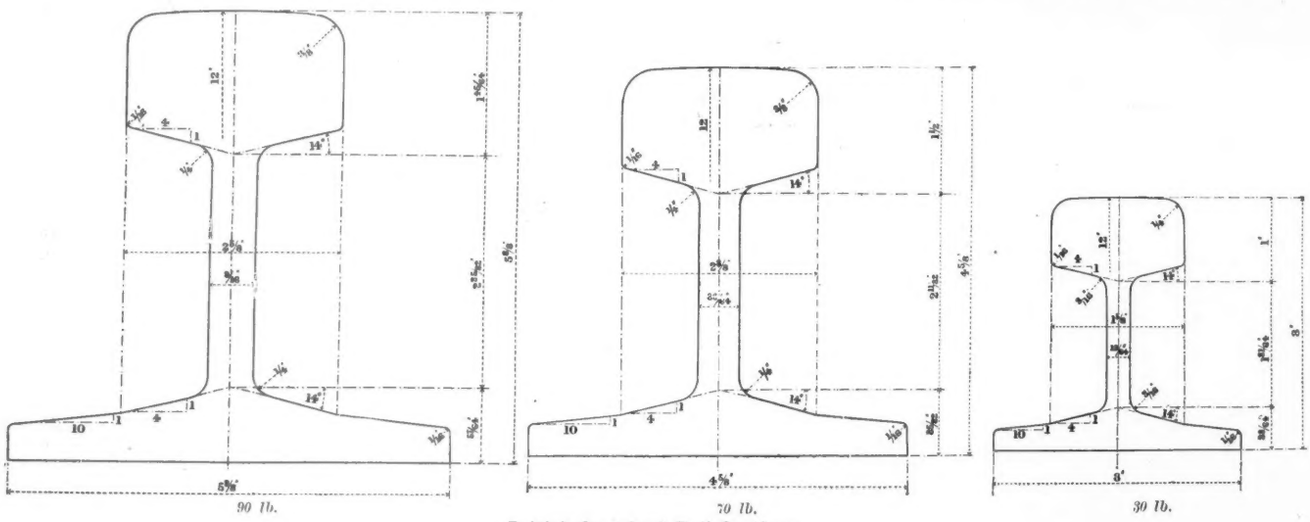
The accompanying sections which are reproduced one-half size, show the general form adopted for the flat-bottom rails, and the table gives the height of rail and width of head for each of the different weights. The chemical requirements are as follows: Carbon, 0.35 to 0.5 per cent.; manganese, 0.7 to 1.0 per cent.; silicon, not to exceed 0.1 per cent.; phosphorus, not to exceed 0.07 per cent.; sulphur, not to exceed 0.07 per cent. Carbon and phosphorus determinations are to be furnished by the manufacturer for each cast, together with a complete analysis of the steel for each rolling, or if the rolling exceeds 200 tons, for each 200 tons or part thereof.

Each rail is to be made from an ingot not less than 12 in. square at one end and 14 in. square at the other end. The ingots must be worked into blooms and be cropped at each for a sufficient length to ensure soundness. A variation of ½ per cent. each way from the specified weight will be allowed, but payments will be made on the specified weight. The allowable variation in length is $^{8}/_{16}$ in. each way measured at a temperature of 60 deg. Fahr.

On the web of each rail there is to be rolled a specified brand to show that the rail is of British standard section; and the number of the British standard section (being the nominal weight of the rail in pounds per yard), the process by which the steel has been made (*i.e.*, Siemens-Martin acid or basic, Bessemer acid or basic, for which the abbreviations S.A., S.B., B.A., B.B., are recommended); the manufacturer's name, initials or other recognized mark, and the month and year of manufacture are also to be rolled, in letters ¾ in. in size, on one side of the web, while the number of the cast or blow is to be stamped on the ends in ½ in. block figures.

A sample is to be taken from each cast and subjected to an impact test; if it shows fracture the entire cast is to be rejected. For this test a piece 5 ft. long is placed horizontally, head uppermost, on two iron or steel supports, from 3 to 3½ ft. apart, according to the weight of the rail, the upper surfaces of which are curved to a radius of 3 in.; and the prescribed test consists of letting a tup or weight, with its striking face curved to a radius of not more than 5 in., and weighing from 560 lbs. to 2,240 lbs., fall from a height of from 8 to 30 ft., according to the weight of the rail under test. The fish-bolt holes must be drilled clean and square, with the web in the position shown on the drawing supplied by the purchaser or engineer, and an error of $^{1}/_{32}$ in. in their size or position renders the rail liable to rejection.

Other provisions regulate the conditions of inspection and testing, the supply of templates by the manufacturer if required, the carrying out of tensile tests, etc. An appendix gives forms of standard tensile test pieces, tables of dimensions and full-size sections of the 17 standard weights.



British Standard Rail Sections.

Dimensions of British Standard Rail Sections.

No. of B. S. section.	Height of rail, in.	Width of head, in.	Nominal weight of rail, lbs. pr yd.
20	2½	1⅜	20
25	2¾	1½	25
30	3	1⅝	30
35	3¼	1¾	35
40	3½	1⅞	40
45	3¾	1 31/32	45
50	3 15/16	2 1/16	50
55	4⅛	2 5/32	55
60	4 5/16	2¼	60
65	4 7/16	2 5/16	65
70	4⅝	2⅜	70
75	4 15/16	2 7/16	75
80	5	2½	80
85	5 3/16	2 9/16	85
90	5⅜	2⅝	90
95	5 9/16	2 11/16	95
100	5¾	2¾	100

Paris Underground Railroads.

The problem of improving existing traction facilities in the city of Paris and of meeting the growth of traffic has lately received much attention. It is suggested that the bankrupt omnibus lines might be taken over by the city, which should convert them to mechanically operated tramways. The Metropolitan electric underground road has work under way on several extensions and has already proved a severe competitor to the surface lines. It is reported that a new deep-level tube railroad is to be built from Montmartre on the north to Montparnasse on the south, a concession having been granted by the city to Messrs. Berlier & Janicot.

New Northern Pacific Directors.

On May 18 the first annual meeting of the Northern Pacific Railroad since 1902 was held at New York and the new board of directors then elected excluded entirely the Harriman interests. The directors re-elected who have served since 1902 are John S. Kennedy, D. Willis James, George F. Baker, Daniel S. Lamont, William P. Clough and Charles Steele. The Harriman directors who retired are E. H. Harriman, Brayton Ives, Samuel Rea, William Rockefeller, Samuel Spencer, James Stillman, Eben B. Thomas and H. McKay Twombly. It will be recalled that Messrs. Harriman, Rockefeller and Stillman were on the board as representatives of the Union Pacific, and that Messrs. Rea, Spencer, Thomas and Twombly were named by Mr. Morgan. The new Northern Pacific directors are John Sloane, Robert Bacon, L. C. Ledyard, George W. Perkins, James M. Hill, Amos T. French, A. S. Cochrane and Payne Whitney. Comment on this election will be found in the editorial columns.

TRADE CATALOGUES.

Electrical Machinery.—The National Electric Company, Milwaukee, Wis., is distributing a handsome booklet bearing the title, "Plants and Types." It consists almost entirely of half-tone illustrations, which illustrate actual installations made by the company. The object of the booklet is to give a general idea of the product rather than detailed descriptions, as these can be obtained from the bulletins which the company issues from time to time.

The Chicago & North-Western sends an attractive folder entitled "Beautiful Suburban Towns," being the suburban towns found along the three lines of the North-Western running respectively north, northwest and west from Chicago. The folder has numerous attractive half-tone views, also a map and a list of golf and country clubs along the line. Fifty-three suburban towns are described, and commutation rates quoted.

Tie Plates.—A pamphlet catalogue devoted exclusively to tie plates has been issued by the Railroad Supply Co., Chicago. Seven

*Complete copies of this report may be obtained from the Engineering Standards Committee, 28 Victoria Street, London, S. W., or from Crosby, Lockwood & Son, 17 Stationers' Hall Court, London, E. C.

different patterns of tie plates are shown, the illustrations all being large half-tone perspectives. The uses of tie plates and the advantages of the different features of the plates shown are enumerated. The book is most artistically designed, the pages, which are heavy enameled paper, having yellow centers with broad white borders.

Jacks and Other Track Supplies.—Bulletin twelve of the Buda Foundry & Mfg. Co., Chicago, deals with jacks—ratchet, friction and ball-bearing. The different classes of each of these types of jacks are illustrated and described, and also a half-tone plate of region parts, with a list, is given. Another Buda publication is a small pamphlet entitled "The Permanent Way," showing various Buda track supplies.

Track Goods.—The Buda Foundry & Manufacturing Co., Chicago, has prepared an attractive pamphlet on "Buda Gold Medal Track Goods," of which two editions, one in Spanish and one in English have been printed. The list of goods includes pressed-steel wheels, hand and push cars, velocipedes, jacks, track drills, car and engine replacers and switch-stands; also Buda anti-friction metals.

Locomotive Inspirators, Etc.—The Hancock Inspirator Co., New York, sends a handsome catalogue, 9 in. x 12 in., illustrating the entire line of goods which it makes, including locomotive and stationary inspirators, locomotive trimmings such as steam valves, check valves, hose strainers, blow-off valves, whistles, cylinder cocks, guide oil cups, etc.

Steam Gages and Valves.—The American Steam Gage & Valve Mfg. Co., Boston, Mass., sends the railroad edition of its catalogue. It is standard size, 6 in. x 9 in., and contains illustrations and descriptions of valves, gages of all kinds, locomotive indicators, safety valve springs, steam whistles, inspectors outfits, etc.

Water Softening Plants.—The Booth Water Softening Company, New York, sends an illustrated booklet descriptive of three different types of machines which it makes. The special advantages and the use of each type is clearly set forth. The pamphlet is illustrated throughout with sectional half-tone cuts.

Portable Electric Tools.—The Cincinnati Electrical Drill Company, Cincinnati, Ohio, sends a folder descriptive of its portable drills and grinders. The drills are made in three sizes, with maximum capacities of ¼ in., ⅜ in. and ½ in. The largest size is fitted with speed change.

Steel Tired Motor Wheels.—The Railway Steel Spring Co., New York, is distributing a new catalogue on steel-tired wheels for motor cars. Each style of wheel is illustrated by a large half-tone view and on the facing page a cross-section. Seventeen styles are shown.

Seamless Steel Tubes.—The Detroit Seamless Steel Tubes Co., Detroit, Mich., is distributing a small folder giving a baker's dozen of reasons why one should use its locomotive flues.

Manufacturing and Business.

The J. G. White Co., of New York, has organized the Canadian White Co., and a $1,000,000 electrical machinery plant is to be built in Montreal.

Bids are wanted June 19 by E. Eveleth Winslow, Captain of Engineers, U. S. Army, Norfolk, Va., for dredging Perquimans river, N. C.

The East St. Louis Locomotive & Machine Shop Co., of East St. Louis, Ill., has given notice that its capital stock is to be increased by $70,000, making its total capital stock $100,000.

The works of the Georgia Car Co. at Savannah, Ga., have been sold under a decree of the United States Court for $40,000 to E. B. Leaf & Co., of Philadelphia. The new owners, it is said, will operate the plant.

The American Locomotive Company is reported to have ordered from the Electric Fire Proofing Co., of New York, 30 locomotive cabs, to be used on electric locomotives which are to be built for the New York Central.

The American Steel Foundries have received an order from the Great Northern Railroad Company for 1,000 truck bolsters to be applied to box cars to be built at the Pressed Steel Car Company's Works, McKees Rocks, Pa.

The American Steel Foundries are making improvements and additions to their plants in the east, and to better handle these plants the District Manager's office will be transferred from Alliance, Ohio, to Sharon, Pa. New office buildings are being erected at Sharon, where a sales department will also be located.

A contract has been given by the Pittsburg Bridge & Iron Works Co. to Trimble Bros., of Pittsburg, for building its new bridge works at North Rochester, Pa., including a building 90 x 196 ft. The plant recently bought at Wabash, Ind., will be removed to this place. The completed works will give employment to about 250 men.

The Navy Department has placed an order with the Ingersoll-Sergeant Drill Company for a class "GC" air compressor to be located at the Portsmouth (N. H.) navy yard. The compressor has compound steam cylinders 19 and 35 in. in diameter, compound air cylinders 32¼ and 20¼ in. in diameter and 24 in. stroke. Its capacity is 2,179 cu. ft. of free air per minute.

The Westinghouse Machine Company has recently established five new branches, and now maintains the following offices: New York, Mr. L. L. Brinsmade; Boston, Mr. E. L. Clarke; Pittsburg, Mr. William Bradford: Chicago, Mr. John B. Allan; Cincinnati, Mr. A. A. Brown; Denver, Mr. C. C. Chappello; Charlotte, N. C., Mr. Stuart W. Cramer; Atlanta, Ga., Mr. Stuart W. Cramer; Philadelphia, M. R. Muckle, Jr., & Co.; San Francisco, Hunt, Mirk & Company.

Dodge & Day, engineers and architects, Philadelphia, Pa., have been commissioned by the Electro-Pneumatic Company to make an examination and report of the latter company's shop methods at Bayonne, N. J., as a basis for improvements. As the result of a similar examination for the Link-Belt Engineering Co., a 25 per cent. increased business was found possible without night work, on the same floor area, on which previously both night and day work were necessary to produce smaller results.

J. G. White & Co., contractors, of New York, announce that Mr. H. J. Slifer has been appointed steam railroad expert of the company. Mr. Slifer is 46 years old and graduated as a mining engineer from the Polytechnic College of Pennsylvania in 1880. He has served on various railroads, and in 1893 was Assistant Chief Engineer of the Milwaukee, Lake Shore & Western. Since 1899 he has been on the Rock Island, and in 1902 was made General Superintendent of the lines between Chicago and Denver.

The buffing room in the brass department at the new Angus shops of the Canadian Pacific Railway, Montreal, presents an interesting illustration of recent advance in the removal of dust from buffing and grinding wheels. Here a Sturtevant exhaust fan with a special form of Sturtevant hood enclosing the wheels insures the withdrawal of all of the dust and fine chips. This system maintains a perfectly clear atmosphere within the room, separates the chips from the dust and prevents the discharge to the outer atmosphere of dust laden air with the attendant disagreeable results.

Bulletin No. 76 of the Bureau of Plant Industry, Washington, D. C., records the results of two years of study and experiment in Indiana by experts of the Department of Agriculture to find an agent to clarify and purify drinking water. It has been shown that a combination of lime and iron and copper sulphate is harmless and is productive of the best results. The American Steel & Wire Co., Chicago and New York, announces its readiness to furnish copper-iron sulphate; also the advice and assistance of a competent force of sanitary engineers to any city, free of charge.

The Texas Tie & Lumber Preserving Co., a part of the Atchison, Topeka & Santa Fe System, has ordered from Allis-Chalmers Co. the machinery for its new tie-preserving plant to be located at Somerville, Texas, near Galveston, including the following apparatus: Five 6 ft. x 132 ft. impregnating cylinders, or retorts, having heavy cast-steel doors at the ends, capable of withstanding a working pressure of 200 lbs. to the square inch; the equipment for two pressure cylinders, 6 ft. x 120 ft.; an experimental cylinder, 4 ft. x 8 ft., with cast-steel doors, that will stand a working pressure of 400 lbs. to the square inch, with auxiliary appliances, and tanks for holding oil. The plant, when completed, will probably be the finest of its kind in the country. In its operation the Rüping process will be used. Heretofore the Santa Fe and other roads have been treating ties by the various zinc-chloride processes, which have thus far been considerably cheaper, but not as good as creosoting. The Rüping process, however, so reduces the amount of oil necessary to be used that the cost of treatment by creosoting is brought down sufficiently to make it economical.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies see advertising page 24.)

Transportation and Car Accounting Officers.

The June meeting of this Association will be held at the King Edward Hotel, Toronto, Ont., June 20 and 21. The following committee reports will be considered: Executive Committee, Committee on Per Diem, Committee on Car Service, Committee on Office Methods and Accounting.

American Society of Mechanical Engineers.

The fifty-first meeting of the American Society of Mechanical Engineers will be held at Scranton, Pa., June 6 to 9. Professional papers on the following subjects will be read: The transfer of heat at high temperatures; standard unit of refrigeration;

formation of anchor ice and precise temperature measurements; some types of centrifugal pumps; microstructure and frictional characteristics in bearing metals; cast-iron, crushing loads and microstructure; smoke and its abatement; can a steam turbine be started in an emergency quicker than a reciprocating engine of the same power? note on efficiency of steam generating apparatus; performance of a superheater; counterweights for large engines; steam actuated valve gear; note on heads of machine screws; belt creep; function of laboratory courses in the curriculum of engineering schools; continuous measuring and mixing machines; and epochs in marine engineering.

PERSONAL.

—Mr. T. F. Whittelsey, who has been appointed General Manager of the Mobile, Jackson & Kansas City, was born March 19, 1856, at Richmond, Ky. He began railroad work in 1876 as a freight clerk on the Lake Shore & Michigan Southern at West Detroit, Mich. Next he became a clerk in the Engineer's office of the same road and later Assistant Track Master of the Air Line division and Track Master of the Chicago division. On Sept. 19, 1887, he was made Superintendent of the Kalamazoo division of the Lake Shore, and later of the Lansing division and of the Michigan division. Early in 1893 he was made General Superintendent of the Toledo & Ohio Central and Kanawha & Michigan. In 1901, owing to the merging of these two roads with the Hocking Valley, Mr. Whittelsey resigned from the service, and on November of that year was appointed General Manager of the Toledo Railway & Terminal Co., which had begun building a belt line and terminal at Toledo. He remained with this company in charge of construction and operation until Dec. 1, 1904, when it was taken over by the Cincinnati, Hamilton & Dayton interests. Recently he became General Manager of the Mobile, Jackson & Kansas City.

—Mr. Thomas F. Torrey, for many years General Sales Agent of the Delaware & Hudson at New York, died May 16 in New York City.

—Mr. H. G. Prescott, who has been appointed Superintendent of the Panama Railroad, began his railroad career as telegraph operator on the St. Louis, Iron Mountain & Southern. He next was on the Mexican Central and Mexican National for seven years, and for the past 17 years has been connected with the Panama Railroad in various positions.

—Mr. George W. Weedon, who will on June 1 become Assistant General Passenger Agent of the Pennsylvania Lines West of Pittsburg, with headquarters at Cincinnati, began railroad work as ticket agent at the union station at Louisville, Ky. He later became Traveling Passenger Agent at Cleveland, which place he leaves to become Assistant General Passenger Agent.

—Mr. Elisha M. Moore, formerly General Freight and Passenger Agent of the Rome, Watertown & Ogdensburg, died May 16, at his home in Syracuse, N. Y., at the age of 70. He began railroad work when 17 years old, in the office of the General Accountant of the Saratoga-Washington Railroad. He subsequently became Assistant Superintendent of the Watertown & Rome, and in 1880 was made General Freight and Passenger Agent of the Rome, Watertown & Ogdensburg. He resigned in 1888.

ELECTIONS AND APPOINTMENTS.

Albany & Hudson.—J. S. Gillespie, Superintendent, has resigned. John P. Maloney, who has been train despatcher, has been appointed Trainmaster in charge of the operation of all train service. Robert P. Leavitt has been appointed General Mechanical Superintendent and Charles Eastman, Roadmaster.

Buffalo & Susquehanna.—E. A. Neal, formerly on the Southern, has been appointed Traffic Manager. The position of General Freight and Passenger Agent has been abolished.

Chicago & Alton.—G. W. Quackenbush, who has been Division Freight Agent at Marshall, Mo., has been appointed Assistant General Freight Agent, with headquarters at Chicago, and L. E. Mahan has been appointed General Live Stock Agent, with headquarters at Bloomington, Ill., succeeding A. Wilson, appointed Southwestern Freight Agent, with headquarters at Fort Worth, Tex.

Chicago & North-Western.—The following changes on the Ashland division are announced: The territory between Lake Shore Junction and Clintonville with branches has been designated as the First division, with J. P. Cantillon as Assistant Division Superintendent, with headquarters at Kaukauna, Wis. From Clintonville to Monico Junction will be known as the Second division, with William Bennett as Assistant Superintendent, with headquarters at Antigo, Wis. The rest of the division from Monico Junction to Ashland is to be under the supervision of L. N. Costly as Assistant Division Superintendent, whose headquarters will remain at Ashland, Wis.

Chicago Great Western.—L. S. Cass has been appointed Assistant to the President, in charge of the Industrial Department.

Cincinnati, Hamilton & Dayton and Pere Marquette System.—F. A. Deverell, who has been chief clerk to the Comptroller, has been appointed Auditor of Disbursements, with headquarters at Cincinnati, Ohio, succeeding J. F. Shepard, resigned to become Auditor of Freight Traffic of the Illinois Central. F. J. Wheeler has been appointed Freight Claim Agent, succeeding F. V. Davis, resigned.

Denver, Enid & Gulf.—W. B. Blanton has been appointed Assistant to the Vice-President and General Manager, with headquarters at Enid, Oklahoma, succeeding B. F. Dunn, assigned to other duties.

Detroit Southern.—Thomas D. Rhodes has been appointed receiver, succeeding Samuel Hunt, deceased.

Douglas, Augusta & Gulf.—John McLean has been elected President; W. M. Toomer, Vice-President; J. C. Reynolds, Secretary, and C. E. Baker, Treasurer, all with offices at Douglas, Ga.

El Paso & Southwestern.—See El Paso-Northeastern System.

El Paso-Northeastern System.—H. J. Simmons has been appointed General Manager and W. F. Crane General Auditor of the El Paso & Northeastern, El Paso & Rock Island, Dawson Railroad, and the Alamogordo & Sacramento Mountain. Mr. Simmons has also been appointed General Manager of the El Paso & Southwestern.

Great Northern.—John C. Eden, Assistant General Traffic Manager, has resigned to enter the iron mining business in northern Minnesota.

Hocking Valley.—Charles F. Mayer, Assistant General Freight Agent, has resigned to take a position with the Sunday Creek Coal Co. H. Q. Wasson, who has been General Agent at Toledo, has been appointed to succeed Mr. Mayer, with headquarters at Columbus.

Kansas City Southern.—The following have been elected directors: Herman Sielcken, D. G. Boissevain, H. Clay Pierce, S. W. Fordyce, former President of the road; John J. Mitchell, President of the Illinois Trust & Savings Bank, of Chicago; J. A. Edson, General Manager of the Cincinnati, Hamilton & Dayton; James A. Blair, Ernest Thalmann, W. F. Harrity, H. R. Duval, Samuel Untermyer, W. M. Craig, President of the First National Bank of Port Arthur, Tex., and John Grierson. The retiring directors are: E. H. Harriman, George J. Gould, John W. Gates, S. R. Knott, President of the road; J. S. Walsh, Edwin Gould, Lawrence Grier, H. P. Wertheim and O. H. Kahn.

Lehigh Valley.—G. C. Arnold has been appointed General Claim Agent, succeeding Charles E. Sayre, resigned.

Mobile, Jackson & Kansas City.—H. P. Latta has been appointed Superintendent of Motive Power, succeeding T. M. Downing, resigned.

Morgan's Louisiana & Texas.—E. E. Shackford, who has been Superintendent of the Houston & Texas Central at Ennis, Tex., has been appointed Superintendent, with headquarters at New Orleans, succeeding W. F. Owen, resigned.

Nacozari.—Guillermo E. Kelly has been appointed Superintendent, succeeding L. H. Van Treese, resigned to go into other business.

New York City Rapid Transit Commission.—George S. Rice has been appointed Chief Engineer.

Northern Pacific.—The following directors have resigned: E. H. Harriman, William Rockefeller, James Stillman, Samuel Rea, Samuel Spencer, H. McKay Twombly, Eben B. Thomas and Brayton Ives. The following have been elected new directors: John Sloan, Robert Bacon, Lewis Cass Ledyard, George W. Perkins, James N. Hill, Amos Tuck French, Alexander Smith Cochran and Payne Whitney.

Philadelphia & Western (Electric).—E. A. Van Brunt is President and John M. Bramlette, General Manager, of this projected electric line in Pennsylvania.

Pittsburg, Fort Wayne & Chicago.—Samuel Rea has been elected a director, succeeding the late Charles E. Speer.

Pullman Company.—John C. Morrison, Superintendent of the Louisville district, has resigned to go into other business, and is succeeded by Charles M. Talcott, agent for the company at Chicago.

Queen & Crescent Route.—H. A. Poveleite has been appointed Assistant General Freight Agent, with headquarters at Cincinnati.

Richmond, Fredericksburg & Potomac.—Judge W. J. Leake has been elected President, succeeding Major E. T. D. Myers, deceased.

St. Louis & San Francisco.—R. H. Gray has been appointed Master Mechanic.

Southern.—A. L. Robinson, Master Mechanic at Princeton, Ind., has resigned to take a position under J. F. Wallace, Chief Engineer of the Panama Canal.

Southern Pacific.—C. B. Seger has been appointed Auditor, with headquarters at San Francisco, succeeding E. S. Benson, recently appointed General Auditor of the Isthmian Canal Commission and of the Panama Railroad.

Toledo Railway & Terminal.—James M. Wisler has been appointed Master Mechanic, succeeding H. P. Latta, resigned.

Wabash-Pittsburg Terminal.—James W. Patterson, Vice-President and Chief Engineer, has resigned.

LOCOMOTIVE BUILDING.

The Western Railroad of Havana is reported to have ordered 16 locomotives.

The Eastern Railroad of France is reported to be in the market for a large number of locomotives.

The Hocking Valley has ordered nine passenger and nine switching locomotives from the American Locomotive Co.

The New York Central & Hudson River is reported to have ordered 30 electric locomotives from the American Locomotive Company.

The Imperial Government Railways of Japan, as reported in our issue of February 24, have ordered 127 simple (type 6Wc) tank locomotives, 77 from the Baldwin Works and 50 from the Glasgow (Scotland) Locomotive Co. These locomotives are to weigh in working order 99,500 lbs., with 81,900 lbs. on drivers; cylinders, 16 in. x 24 in.; diameter of drivers, 49 in.; Crampston boiler, with a working steam pressure of 160 lbs.; 192 brass tubes 1¾ in. in diameter and 10 ft. 6 in. long; copper firebox, 82 in. x 34 in.; tank capacity, 1,716 imperial gallons, and coal capacity, 3,400 lbs. The special equipment includes: Vacuum Brake Co. of England's vacuum brakes, injectors to be either (1) two of Gresham & Craven's combination brass injectors, one No. 7 and the other No. 8; or (2) Sellers self-acting injectors, one No. 6½ and the other No. 7½, or (3) Nathan simplex injectors, type R; United Metallic Packing Syndicate's metallic piston rod packings, Ramsbottom safety valves, Vacuum locomotive or other approved sight-feed lubricators, tires to be made by any of the following makers: Charles Cammell & Co., Fried. Krupp, Steel, Peech & Toser, Taylor Bros. & Co., Latrobe Steel Co., Midvale Steel Co., Standard Steel Co., Thomas Firth & Sons, and Vickers Sons & Maxim.

The Chicago & North-Western, as reported in our issue of May 5, has ordered 30 ten-wheel (4-6-0) class M-1 freight locomotives from the Schenectady Works, and 20 six-wheel (0-6-0) class R-1 switching locomotives from the Rhode Island Works of the American Locomotive Co. The ten-wheel locomotives are to weigh 162,500 lbs., with 126,000 lbs. on drivers and 36,500 lbs. on trucks; weight of tender, 140,000 lbs.; total weight engine and tender, 302,500 lbs.; theoretical tractive force, 36,400 lbs.; maximum available force, 29,100 lbs.; driving wheel base, 14 ft. 10 in.; engine wheel base, 25 ft. 10 in.; total wheel base engine and tender, 57 ft. 9 in.; diameter of cylinders, 21 in. x 26 in.; diameter of drivers, 63 in.; diameter of driving wheel centers, 56 in.; extended wagon-top boiler, with a working steam pressure of 200 lbs.; total heating surface, 2,974 sp. ft.; 337 tubes, 2 in. in diameter and 16 ft. long; firebox, 102⅛ in. x 65¼ in.; grate area, 46.27 sq. ft.; tank capacity, 7,500 gallons, and coal capacity, 10 tons. The switching locomotives are to weigh 106,800 lbs. on drivers; weight of tender, 97,000 lbs.; total weight engine and tender, 203,800 lbs.; theoretical tractive force, 26,000 lbs.; maximum available force, 20,800 lbs.; engine wheel base, 11 ft.; total wheel base engine and tender, 40 ft. 9 in.; cylinders, 18 in. x 24 in.; diameter of drivers, 51 in.; diameter of driving wheel centers, 44 in.; straight top boiler, with a working steam pressure of 170 lbs.; total heating surface, 1,371.81 sq. ft.; 203 tubes, 2 in. in diameter and 11 ft. 10 in. long; firebox, 82 in. x 40⅜ in.; grate area, 22.42 sq. ft.; tank capacity, 4,800 gallons, and coal capacity, eight tons.

The Pere Marquette has ordered five Atlantic type (4-4-2) passenger locomotives and 20 consolidation (2-8-0) freight locomotives from the Brooks Works, and 10 six-wheel (0-6-0) switching locomotives from the Rhode Island Works of the American Locomotive Co., the Atlantic type and consolidation locomotives for August delivery and the switching locomotives for August and September delivery. The Atlantic type locomotives are to weigh 150,000 lbs., with 90,000 lbs. on drivers; cylinders, 19 in. x 26 in.; diameter of drivers, 73 in.; radial stayed extended wagon-top boiler, with a working steam pressure of 210 lbs.; 248 tubes 2 in. in diameter and 14 ft. $6^{1}/_{16}$ in. long; firebox, 90 in. x 68 in.; tank capacity, 5,000 gallons, and coal capacity, 10 tons. The consolidation locomotives are to weigh 173,000 lbs., with 153,000 lbs. on drivers; cylinders, 19½ in. x 28 in.; diameter of drivers, 57 in.; radial stayed wagon-top boiler, with a working steam pressure of 200 lbs.; 302 tubes 2 in. in diameter and 14 ft. long; firebox, 95 in. x 67¼ in.; tank capacity, 5,000 gallons, and coal capacity, 12 tons. The switching locomotives are to weigh 132,000 lbs. on drivers; cylinders, 19 in. x 26 in.; radial stayed straight-top boiler, with a working steam pressure of 180 lbs.; 280 tubes, 2 in. in diameter and 11 ft. long; firebox, 108 in. x 41⅞ in.; tank capacity, 4,000 gallons, and coal capacity, eight tons. The special equipment for all will include: New York automatic air-brakes, American Locomotive Co.'s axles, Cook bell ringer, Phillips & Carey boiler lagging, National-Hollow brake-beams, Tower couplers, Nathan injectors, Coale safety valves, Railway Steel & Spring Co.'s springs, and, for Atlantic type locomotives, Martin steam heat equipment.

CAR BUILDING.

The New London Street Railroad is reported to have ordered four cars.

The Chicago, Rock Island & Pacific is reported to have ordered 1,700 refrigerator cars.

The Chicago & North-Western has ordered 1,000 box and 500 stock cars from the Pullman Co.

The Western Railroad of Havana is reported to have ordered 125 reconstructed freight cars.

The Missouri, Kansas & Texas has ordered 2,000 box cars from the American Car & Foundry Co.

The Cardenas & Jucaro Railroad of Cuba is reported to have ordered 100 flat cars and 75 reconstructed box cars.

The J. G. Brill Company, of Philadelphia, is reported to have an order from the Companhia Mineira de Electricidade, of Rio de Janeiro, Brzil, for a number of open tramway cars.

The Missouri Pacific has ordered 2,000 gondolas from the Western Steel Car & Foundry Co., 1,000 gondolas and 1,000 box cars from the Mount Vernon Car Manufacturing Co., and 1,000 box cars from the American Car & Foundry Co.

The Atchison, Topeka & Santa Fe has ordered 1,000 combination stock and coke cars of 70,000 lbs. capacity from the American Car & Foundry Co. These cars will be 40 ft. long, 8 ft. 6 in. wide and 8 ft. high, all inside measurements. The special equipment includes: Westinghouse air-brakes, R. E. Janney couplers, Miner draft rigging, Soule dust guards and McCord journal boxes.

The Morgantown & Kingwood, as reported in our issue of May 12, has ordered 300 twin hopper steel gondolas of 100,000 lbs. capacity from the Butler Works of the Standard Steel Car Co., for August delivery. These cars are to weigh about 40,000 lbs., and measure 40 ft. long and 9 ft. 5⅝ in. wide, inside measurements, and 40 ft. 9 in. long and 10 ft. wide, over all, with metal frames and underframes. The special equipment will include: Simplex bolsters, Westinghouse air-brakes, Damascus brasses, Tower couplers, Miner draft rigging and National wheels.

BRIDGE BUILDING.

AINSWORTH, NEB.—Bids are wanted June 15 for building a bridge over the middle channel of the Niobrara river in Brown County. E. B. Smith is County Clerk.

BERWICK, PA.—The Board of Public Buildings and Grounds has under consideration the question of building a new bridge over the Susquehanna river here to replace the structure carried away by floods last year, to cost about $150,000.

CADILLAC, MICH.—Bids are wanted June 20 by W. J. Smith, City Clerk, for building two steel bridges, one 350 ft. long and one 66 ft. long.

CARROLLTON, GA.—Local reports state that the Central of Georgia is putting in a new steel bridge over the Tallapoosa river near this place, and will build six others over tte Flint, Big Tallapoosa, Etowah, Oostanaula and Chattanooga rivers and Chickamauga creek to accommodate the heavier rolling stock.

CHELSEY, ONT.—Bids are wanted June 17 by W. McDonald, Warden of Bruce County, for building two concrete abutments about 500 cu. yds., one pier about 175 cu. yds., and for the steel superstructure of a bridge 230 ft. with 16-ft. roadway.

CLEVELAND, OHIO.—The Cleveland Terminal Railroad bridge over the Cuyahoga river which has been condemned, is to be replaced by a new structure which is to have an opening of 210 ft.

DOVER, DEL.—The Kent County Commissioners have decided to build a bridge over Fannell's branch near Chestertown.

LONDON, ONT.—Bids are being asked by F. W. Farncomb for building a steel bridge at Melrose in Loba township.

MARLIN, TEX.—The Commissioners of Falls County have authorized the building of a steel bridge over Deer creek to replace a structure carried away by high water.

MEXICO CITY, MEX.—The Mexican (Vera Cruz) Railroad Co. has under consideration the project of building a large bridge over the Metlac canyon to replace the bridge which now spans that chasm. Plans and estimates for the proposed bridge place the cost at not less than $4,000,000. The structure will be the longest and highest bridge in Mexico and will do away with the 2½ per cent. grade at either end of the bridge.

MITCHELL, ONT.—Bids are wanted June 6 by William Davidson, County Clerk of Perth, for building a steel bridge 138 ft. long over the Thames river at the towns of Fullerton, Blandshard and Downie; also for the abutments and wing walls and for the necessary approaches.

Moncton, N. B.—Bids are wanted May 31 by D. Pottinger, General Manager of the Intercolonial, for building the substructure of the double-track bridge to be built near Bedford station, N. S.; also for the substructure of two single-track bridges, one to be built near Mitchell station, Quebec, and the other near St. Leonard Junction, Quebec.

Owen Sound, Ont.—The Town Council has decided to build a steel bridge over the Sydenham river at Poulett street.

St. Augustine, Fla.—A bridge, it is reported, is proposed to be built over the Matanzas river, connectinng this place with Anastasia Island.

Weatherford, Tex.—A contract has been given to Mitchell & Pigg, of Parker County, at $28,000 for building two bridges over the Brazos river, one at Bannon crossing and the other at McDonald crossing.

West Newton, Pa.—Plans have been made for building a bridge over the Youghiogheny river at this place, to cost about $65,000.

Wheeling, W. Va.—A stone bridge over Wheeling creek is proposed.

Other Structures.

Bloomfield, Pa.—The New York, Susquehanna & Western, it is said, has bought a site on which it will build a new station and a roundhouse.

Chattanooga, Tenn.—According to local reports, the Cincinnati, New Orleans & Texas Pacific and the Southern will jointly rebuild and remodel the central station.

Galveston, Tex.—The Chicago, Rock Island & Pacific will build a pier west of the Southern Pacific dock and spend a large sum on terminal improvements, including a large elevator.

Grand Junction, Colo.—The Denver & Rio Grande Railroad will put up a brick passenger station, for which the foundations have already been completed. It is to be two stories high, 60 ft. x 190 ft., for which bids will be asked about June 5 by E. J. Yard, Chief Engineer, Denver, Colo.

Harrisburg, Pa.—The Philadelphia & Reading has given a contract to Sparks & Evans, of Philadelphia, to build a subway 33 ft. wide to hold two tracks and two roadways at the Rutherford station.

Johnson City, Tenn.—The Southern is making plans to put up a new passenger station to replace the present structure.

Moncton, N. B.—Bids will soon be asked by the Intercolonial for building a new work shop 150 x 658 ft. and a new erecting shop to contain 24 pits; also for building stores and offices, all of which are to be of brick and stone construction.

Rochester, N. Y.—Local reports state that the Buffalo, Rochester & Pittsburg will put up a large freight house on the site of the present one at Oak street. A large paint and repair shop will also be built adjoining the car shops at Lincoln Park.

Sioux Falls, S. Dak.—Plans have been completed for the new Chicago & North-Western passenger station, to replace the structure destroyed by fire.

Tyler, Tex.—The St. Louis Southwestern is ready to begin work on a new brick freight house and sheds to cost about $50,000.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

Alabama Central.—This company has recently completed its line from Booth Station, on the Mobile & Ohio, to Autaugaville, a distance of eight miles, and the road has been opened for traffic.

Alaska & Pacific Railway & Telegraph Co.—Incorporation has been granted a company under this name, with a capital of $2,000,000, in the State of Washington, to build a railroad from a point opposite the northern end of Martin's Island into the interior of Alaska. The incorporators include: James Buzzard, J. C. Jeffrey and William Wray. The principal offices are to be at Seattle, Wash.

Appomattox & Charlotte.—A charter has been granted to this company in Virginia to build a railroad from Appomattox to Drake's Branch, Va., about 30 miles. The incorporators include: B. P. Eggleston, President, of Drake's Branch, and S. L. Ferguson, Vice-President and Secretary, of West Appomattox.

Bayfield, Lake Shore & Western.—A contract has been let to W. H. Johnson, of Superior, Wis., to build the extension of this road to Cornucopia. The road will pass through a rich timber territory.

Bessemer & Lake Erie.—According to reports, an extension of this road is proposed from Cranesville to Elk Harbor, about five miles. At the latter point large shops are to be built.

Canadian Pacific.—A contract, it is reported, has been awarded by this company to George S. Deeks & Co., for building the southern section of its branch from Toronto to Sudbury. The contract covers the portion of the road between Parry Sound and Bolton, a distance of 128 miles, and work will be begun at once. The Toronto-Owen Sound branch will be used as far as Bolton.

An officer is reported as saying that it has finally been decided to double track and improve the section of this road between Winipeg and Fort William, 427 miles. The grade is to be reduced to a maximum of .4 per cent., and it is proposed to finish the work in three years.

Cananea, Yaqui River & Pacific.—This company, which has offices at Cananea, state of Sonora, Mexico, and now operates about 40 miles of road, is planning to extend its line in acordance with the concession granted by the Mexican Government. There are five divisions of the proposed system authorized under the concession. The first is from Naco to Cananea, which has been completed. The second division will extend from Guaymas to a point near Torin, thence up the valley of the Yaqui river to Tohichi. The third division will be built from some point on the second division to Alamos, the fourth division will be built from some point on the third division to the ports of Agiabampo and Topolobampo, on the Pacific coast, and the fifth division will be built up the valley of the Yaqui river north to the Arizona boundary near San Bernardino. Under the terms of the concession, it is required that 100 miles of road shall be built the first year on the second and third divisions, and not less than 35 miles each following year for four years. The lines to the ports of Agiabampo and Topolobampo and to the Arizona boundary may be built later at the convenience of he company. The company is said to be backed by the Phelps-Dodge syndicate.

Cape Breton.—A subsidy of $6,400 a mile has been granted by the Dominion Government to this road. This, with the aid granted by the local government is to enable the company to finish its line from Point Tupper east to Louisburg, 70 miles. Thirty-one miles of this line to St. Peters are already in operation.

Chicago & Eastern Illinois.—Surveys are being made for the proposed extension of this road from Salem to Springfield, Ill., about 90 miles.

Coahuila & Pacific.—This company, according to reports, is planning to extend its road to the Pacific coast of Mexico. It is reported that the line will at once be extended from Minaca, the present western terminus, west to Ocampo, a distance of about 87 miles.

Coast Line Railway (Southern Pacific).—An officer writes that this company, which was recently incorporated in California, will build a road from San Francisco to Santa Cruz via Pescadero, for which surveys are now being made. N. T. Smith is President and William Hood, Chief Engineer, San Francisco, Cal. (April 28, p. 142.)

Columbus Northern.—A charter has been granted this company in Georgia, with a capital of $100,000, to build a riiroad from Columbus to Lagrange, through Muscogee, Harris, Meriwether and Troup Counties, a distance of 60 miles, through a rich agricultural section. The incorporators include Charles L. Davis, of Warm Springs, Meriweather County; O. C. Bullock, T. W. Bates, R. O. Howard and others, of Columbus.

Colorado, Columbus & Mexican.—This company, which was recently incorporated in Mexico with a capital of $5,000,000, will build a railroad from Monterey to Salt Lake City, Utah. John G. Halzinger, of El Paso, Tex., is interested and may be addressed.

Culver & Port Clinton.—Incorporation has been granted this company in Ohio to build a railroad from Gypsum to East Toledo, with the privilege of operating a branch from a point in Harris township, in Wood County, to Bowling Green. The incorporators include: G. A. Esch, M. Brennan, J. McNaught, O. M. Knode and O. B. English.

Cumberland River & Nashville.—This company, which proposes to build a railroad from Corbin, Ky., to the Tennessee line and eventually to Nashville, has let a contract, it is reported, for building the first 20 miles from Burnside, on the Cincinnati Southern, to Monticello. Surveys are being made south to the Tennessee line, a distance of 95 miles, of which surveys for 63 miles have been completed.

Delaware & Hudson.—This company, it is reported, will build a third track from Jermyn to Carbondale, Pa., for the accommodation of its coal and freight traffic, which is now heavy between these points.

Delaware, Lackawanna & Western.—This company is receiving bids for making a new coal storage yard at North Taylor, near Scranton, Pa. The yard will require about 250,000 yards of grading, and will be over a mile long. The yards at Keyser Valley are also to be extended.

Farmers' Grain & Shipping Company's Railroad.—The stockholders of this company, which operates a line from Devil's Lake to Starkweather, N. Dak., 25 miles, have decided to extend the road for a distance of 35 miles northwest from Starkweather, the present terminus.

Great Western Construction & Development Company.—Under this name a number of Colorado capitalists have organized a company to build a railroad from the coal fields in Archuleta County to the Denver & Rio Grande main line, about 40 miles. Rights of way are now being secured.

Indiana Harbor.—An officer writes that this company, which is building from Indiana Harbor, Ind., south to Danville, Ill., has given contracts and work is now in progress from Hartsdale to Danville. The contractors include: Winston Bros., of Minneapolis; McArthur Bros., of Chicago, and the Knickerbocker Ice Co., of Chicago, for the grading. Other contracts have been let to the American Bridge Co., Bates & Rodgers, Union Switch & Signal Co., and the Federal Railway Signal Co. The contracts cover the building of a double-track railroad throughout, and one track, it is expected, will be finished to Danville during the present year. The maximum curve will be 1 degree and the maximum grade north is 12½ ft. to the mile and south 18 ft. to the mile. Charles Hansel is Consulting Engineer, La Salle street station, Chicago, Ill.

Interoceanic.—Surveys are being made by this company between the City of Mexico

and the port of Vera Cruz to shorten the line and lower the grades. J. M. Reid, Chief Engineer of Construction, Mexico City, is in charge of the work.

KINGSTON, BRIGHTON & NORTHERN.—A charter has been granted this compauy in Virginia, with a capital of $100,000, to build railroads to be operated by steam or electricity. W. E. Dickinson, of New York, is President; W. G. Smith, of Cape Charles, Va., Vice-President, and G. W. Morton, Secretary. The headquarters of the company will be at Cape Charles.

LAKE ERIE, MAHONING & SOUTHERN.—Under this name a company with a capital of $2,000,000 will ask for incorporation in Ohio to build a railroad from Youngstown, Ohio, to Salem, about 24 miles. Pittsburg and Chicago capitalists are said to be back of this project. Connection is to be made with the Pennsylvania, the Baltimore & Ohio and the Wabash railroads.

LEHIGH VALLEY.—It is reported that this company is making extensive improvements to its line between Wilkesbarre, Pa., and Glen Summit, and is also preparing to lay a third track from Beaver Creek Junction to Glen Summit, and probably as far as the Fairview cut-off.

LINVILLE RIVER.—This company, it is reported, will build an extension from Saginaw to Mortimer, N. C., 15 miles. J. T. Montgomery, of Lenoir, N. C., is Chief Engineer.

LOUISIANA RAILROAD & NAVIGATION.—According to reports, this company is planning to build a railroad from Pineville to Jena, in Cathoula parish, La., a distance of about 30 miles. Surveys are being made.

LOUISVILLE & NASHVILLE.—The new line between Bay Minette, Ala., and Fort Morgan, a distance of about 60 miles, which is to be used as a feeder for the Montgomery & Mobile branch of the Louisville & Nashville, has been put in operation.

MEXICAN ROADS.—The Mexican Coal & Coke Co., according to reports, will build a line from Las Esperanzes to Monterey, about 175 miles, where its coal mines are situated.

It is reported that a road will be built from Saltillo to Galeana, about 85 miles. Several preliminary surveys have been made, but the route has not yet been definitely decided. C. C. Pierce, of Laredo, Tex., may be addressed.

Application has been made to the government of the State of Jalisco by Carlos Romero, of Etazatlan, for a concession to build a railroad from Orendain, on the Mexican Central to Hostotipaquillo. It is claimed that financial backing has been provided for and that construction work is to be commenced as soon as the concession is granted.

The Metallurgica Mexican has completed preliminary surveys for building a road from a point on the San Pedro branch of the Potosi & Rio Verde to its mines situated in the San Pedro district; also to other mines adjacent to San Luis Potosi.

The Mexican Coal & Coke Co. is reported to be building a road from its coal mines near Las Esperanzes, state of Coahuila, to Paredon, about 130 miles, where connection will be made with the Mexican Central. The road is to be operated by a separate corporation which will be known as the Coahuila Coal Railroad Co.

A project is under way for building a railroad through a rich mineral section of Western Mexico to run from Ameca to Banderas Bay, on the Pacific coast. Preliminary surveys are reported completed by F. M. Ames, an engineer representing a syndicate of American capitalists, headed by A. W. Geist.

MIDDLETOWN & ODESSA.—Work, it is reported, will be started at once on this road by the contractors, the Tennis Construction Co., of Philadelphia, from Odessa, Del., to Delaware City, a distance of nine miles.

MINNEAPOLIS, ST. PAUL & SAULT STE. MARIE.—It is reported that the Bismarck, Washburn & Great Falls road, recently purchased by this company, will be extended from Underwood to Minot, N. Dak., 60 miles.

MISSOURI, KANSAS & TEXAS.—This road, it is reported, will extend its line from Colmesneil, Tex., to Doucette, ten miles.

NATIONAL OF MEXICO.—This company has bought the railroad which runs from Bermejillo to Mapimi and the road is being changed from narrow to broad gage. It will be operated as part of the Mexican International division of the merged roads.

NEVADA & CALIFORNIA (SOUTHERN PACIFIC).—This company, which has recently been incorporated in California, an officer writes, is under construction between Hazen, Nev., Churchill, Heeler and Mojave, with a branch line from Churchill to Mound House. William Hood, San Francisco, Cal., is Chief Engineer. (April 14, p. 122.)

NEW YORK CENTRAL & HUDSON RIVER.—The New York & Ottawa which was bought last winter, is to be rebuilt during the present summer to accommodate heavier cars and engines.

NOVA SCOTIA EASTERN.—Nova Scotia papers say that the entire bond issue of $20,000 a mile for this projected railroad in Nova Scotia has been underwritten in London. The bond issue for the whole road is about $5,000,000, and the road has been promised a subsidy from the Nova Scotia Government of $5,000 per mile, and from the Federal Government one of $3,200 per mile. With the $20,000 in bonds to be issued by the company this would make a total of $28,200 per mile. The line is to run from Dartmouth east along the shore through Cole Harbor, Lawrencetown and Chezzetcook to Upper Musquodoboit, Melrose and Guysboro to a point on the strait of Canso, with a branch from Melrose up the east branch of the St. Mary's river to New Glasgow, and another branch down the Country Harbor river to Country Harbor, a total of about 175 miles. J. W. Grier, Vice-President of the company, is reported to have left for England to close contracts for the work.

OHIO RIVER NORTHERN.—A charter has been granted this company in Ohio with a capital of $50,000 to build a steam railroad from East Liverpool to Lisbon, in Columbiana County, 21 miles. The incorporators include: John C. Wallace, Alfred T. Kelley, J. N. Vodrey, G. W. Clark and D. M. McLane.

OHIO TRACTION.—The Ohio Traction Co. has been incorporated in Ohio with a capital stock of $20,000,000, and headquarters at Cincinnati, to take over interurban and street railroads in and between Cincinnati and Hamilton. The directors include: Thomas Dolan, Randall Morgan, P. A. B. Windner and George W. Elkins, of Philadelphia.

ORANGE & NORTHWESTERN (ST. LOUIS & SAN FRANCISCO).—A contract has been let to Kenefick, Hammond & Quigley, of St. Louis and Kansas City, for building an extension from Orange to Newton, a distance of 31 miles.

PARRAL & DURANGO.—The survey of this company for its proposed extension from Mesa de Sandia to Guanacevi has been completed, and construction work is soon to be commenced.

PHILADELPHIA & READING.—The contract for the enlargement of the Rutherford yards near Harrisburg has been given to Ryan & Kelley, of Philadelphia, and the work has been begun. There will be 500,000 cu. yds. of grading, and 24 additional tracks are to be laid between Rutherford and Beaver Creek. New tracks will also be laid between Boyd Station and Beaver Creek, which will be used exclusively for passenger traffic. The work will require the building of a bridge over Beaver Creek and the construction of two costly subways, one 3,000 ft. west of Beaver Creek and the other 1,000 ft. from Beaver Station, the latter of which will do away with the dangerous grade crossing at Rutherford. Work is to be completed within eight months.

PITTSBURG, BINGHAMTON & EASTERN.—This company, which is organized under the laws of Pennsylvania and New York, plans to build a road from Ansonia, Pa., crossing the Lehigh Valley at Towanda, Pa., and the Northern Central at Canton, Pa., to Binghamton, N. Y., 143 miles. The Maximum grade is to be 1¼ per cent., and the road will reach numerous coal mines. E. H. Gay & Co., of Boston, are to manage the finances and to offer $5,000,000 first mortgage 5 per cent. gold bonds and $4,000,000 4 per cent. preferred stock cumulative after January 1, 1909.

RALEIGH & SOUTHPORT.—The name of the Raleigh & Cape Fear, which runs from Raleigh southeast to Lillington, 35 miles, has been changed to the Raleigh & Southport. An extension is now being built to Fayetteville, and it is announced that it will be extended to Southport.

ST. LOUIS & SAN FRANCISCO.—This company, it is reported, will build a line from a point opposite Joppa, Ill., to Paducah, Ky., a distance of 20 miles. Arrangements are said to have been entered into with the Illinois Central by which the tracks of the latter company will be used from Paducah to Hopkinsville, Ky.

ST. LOUIS, LITCHFIELD & EASTERN.—This road has been incorporated in Illinois to at once construct a steam road from Litchfield to Alton, Ill., 40 miles. The officers of the company are: J. H. Belt, of Bunker Hill, President; J. E. Kelsey, of Bethalto, Ill., Vice-President; H. R. Budd, Bunker Hill, Ill., Secretary, and C. E. Drew, Bunker Hill, Treasurer.

SOUTHERN PACIFIC.—Application has been made to the Mexican Government on behalf of this company by J. A. Naugle, General Manager of the Sonora branch, for a concession to build and operate a railroad from Guaymas, down the Pacific coast through the ports of Agiabampo, Topolobampo and Mazatlan to Culiacan, and thence to the city of Guadalajara, about 800 miles. It is reported that work will be begun as soon as the concession is granted.

SUSQUEHANNA & EAGLES MERE.—This, it is reported, will be the name of a narow-gauge lumber road, which is being built from Eagles Mere to Hillsgrove Junction, Pa., on the Susquehanna & New York, a distance of 20 miles. Part of the line has in the past been used for hauling lumber, and the entire road will traverse a rich timber district. Charles W. Sones is the promoter.

TENNESSEE-ALABAMA INTERURBAN.—Permission has been granted this road by the Government to build a railroad from Army Post through Chickamauga Park to Ducktown, Tenn., via Ringgold and Catoosa Springs, Georgia, connecting with the Western & Atlantic at Ringgold, and connection will also be made with the Louisville & Nashville, giving a short route to Ducktown. The plans of the company include the building of a tunnel at Missionary Ridge, for which a franchise will be asked from the County Court at the next session. The road may be converted into a steam road.

TIDEWATER.—A contract has been given to Oliver & Sands, of Roanoke, Va., for building the first 100 miles of this road from Norfolk west. The route lies 10 miles north of the Southern, and will run from Small's Point by way of the Norfolk & Western to Smoky Ordinary, in Brunswick County, between the Norfolk & Western and the Southern.

TWIN CITY RAPID TRANSIT.—This company, which has largely added to its power plant and equipment, is planning to build about 50 miles of new line in the cities of St. Paul and Minneapolis.

WABASH-PITTSBURG TERMINAL.—An officer writes that this company will build a branch

from the West Side Belt Railroad to connect with the Monongahela Southern, owned by the United States Steel Corporation, for which contracts have been let to J. G. Corcoran, of Pittsburg, Pa., and work will be begun at once. The character of the work will be light, with a maximum grade of 1 per cent. and a maximum curvature of 5 degrees. There will be no important bridges or tunnels.

RAILROAD CORPORATION NEWS.

ALGOMA CENTRAL & HUDSON BAY.—See Canada Central below.

BALTIMORE & OHIO.—Gross earnings for the month of April were $5,723,582, an increase of $222,304 over last year. Net earnings were $1,789,940, an increase of $158,878. For the ten months ending April 30, gross earnings were $56,081,718, an increase of $1,635,502, and net earnings were $9,317,381, an increase of $1,216,503.

CANADA CENTRAL.—The Lake Superior Corporation has applied to the Legislature of Ontario for permission to consolidate the railroads which it controls, including the Algoma Central & Hudson Bay and the Manitoulin & North Shore, under the name of the Canada Central Railroad. The company says that it is ready to spend $150,000 in construction work within a year and $500,000 within two years.

CHESTERFIELD & LANCASTER.—Bids will be received until May 31 at the office of the company in Cheraw, S. C., for $250,000 30-year 5 per cent. first-mortgage bonds. The company's line is 21 miles long, standard gage, and runs from Ruby, S. C., to Cheraw.

CHICAGO GREAT WESTERN.—Application has been made to the New York Stock Exchange by this company to list $1,738,700 additional common stock.

LA FAYETTE RAILROAD.—This road, which was built nine years ago by the citizens of Lee and Chambers Counties, Ala., paralleling a branch of the Central of Georgia, appears to have come under the control of that road, for recently the work of tearing up its tracks was begun under the direction of its own President and General Manager. The road runs from La Fayette, Ala., to Opelika, 22 miles, and has afforded an outlet from the former town to the Western of Alabama. In order to stop the tearing up of the tracks by the company an injunction has been issued restraining the President and General Manager and all other employees from dismantling the road. Nearly four miles of track are reported to have been torn up when this injunction was issued.

LOGANSPORT & TOLEDO.—The final annual report for 1904 of this company, which was merged January 1 into the Vandalia Railroad, shows, for the 93 miles of line from Logansport to Butler, Ind., earnings from freight traffic of $151,192, a decrease of $15,076 from 1903; earnings from passenger traffic of $49,780, an increase of $8,239, and total gross earnings of $211,840, a decrease of $5,960. Expenses were $205,221, leaving net earnings of $6,619, a decrease of $6,550. The deficit for the year was $57,551 against $50,597 in 1903. During the year there was an increase of $5,744 in conducting transportation and of $1,319 in maintenance of equipment, and a decrease of $1,123 in maintenance of way expenses. The authorized amount of capital stock is $2,000,000, of which 49 shares, or $4,900, are at present issued. The interest-bearing debt consists of $1,615,000 due the Pennsylvania Co. at 4 per cent. interest. During the year, 83,174 tons of bituminous coal were carried, a decrease of 74,063 tons from 1903. The operating ratio was 96.88 per cent., against 93.95 per cent. in 1903. See Terre Haute & Logansport.

NEW MEXICO RAILWAY & COAL.—President C. D. Simpson, of this company, announces that Phelps, Dodge & Co. have bought control and now own the entire $3,000,000 common and $1,000,000 preferred stock of the New Mexico Railway & Coal Co., which controls the El Paso & Northeastern, El Paso & Rock Island, and Dawson Railway & Coal Co. These affiliated companies operate 462 miles of road in New Mexico.

NEW YORK, NEW HAVEN & HARTFORD.—In reply to the order of the Massachusetts Legislature asking information in regard to the investments made by this company in electric railroads, President Mellen has reported that the New York, New Haven & Hartford owns 99,985 of the 100,000 shares of the Consolidated Railway Co. of Connecticut. The Consolidated company has outstanding $5,055,000 in mortgage bonds, $11,778,000 in debentures, and $550,000 in promissory notes. The Consolidated Company owns shares in Massachusetts street railroad companies as follows: 1,500 shares of the Worcester & Webster, 500 of the Webster & Dudley, 7,000 of the Worcester & Southbridge, 600 of the Worcester & Blackstone Valley, and 9,159 of the Berkshire. This is in addition to its interest in the Springfield Railway Companies which controls the stock of the Springfield Street Railway. In addition, the Consolidated controls the following Connecticut electric roads: Fair Haven & Westville, Montville Street Railway, Middletown Street Railway, Portland Street Railway, Meriden Electric, Wallingford Tramway, Putnam & Thompson Street Railway, People's Tramway, Worcester & Connecticut Eastern, Danielson & Norwich, Norwich Street Railway, New London Street Railway, New York & Stamford Co., Greenwich Tramway, Suffield Street Railway, and Hartford Street Railway.

NORTH SHORE.—This California company, which recently defaulted on its $2,000,000 of outstanding bonds, has deposited with the Mercantile Trust Co., of San Francisco, the trustee of the mortgage, $2,100,000 in cash, representing the entire principal and accrued interest of the outstanding $2,000,000 bonds. The Mercantile Trust Co. has declared the entire bond issue due and given notice that bondholders may receive par and two interest payments due by surrendering their bonds. These bonds are 40-year 5-per-cents, and it is reported that as, since the Southern Pacific interests gained control of the road, an issue at a lower rate than 5 per cent. could easily be sold, the redeeming of the 5 per cent. bonds is simply preparatory to an issue at a lower rate.

ST. LOUIS, ST. CHARLES & WESTERN (ELECTRIC).—This road, which runs from St. Louis northwest to St. Charles, Mo., 19¾ miles, and controls the St. Charles & St. Louis Bridge Company, is to be sold on July 17 at Clayton, Mo., at public auction. It has been for some time in the hands of a receiver. The property of the road includes a contract with the United Railways of St. Louis to operate its cars over any of the lines of the United Railways.

SOUTH DAKOTA CENTRAL.—A stockholder of this road, which runs from Sioux Falls, S. Dak., the terminus of a branch of the Illinois Central, to Colton, 20 miles has applied for a receiver, alleging that the company is insolvent and that fictitious stock has been issued.

TENNESSEE RAILROAD.—A special meeting of the stockholders will be held on July 14 to vote upon a proposition to create a first mortgage, on which bonds are to be issued. The road runs from Oneida, Tenn., to Almy, four miles.

TERRE HAUTE & LOGANSPORT.—This company, which operates 159 miles of road from Rockville to South Bend, Ind., and 23 miles from Terre Haute to Rockville leased from the Evansville & Terre Haute, a total of 182 miles, has made its final annual report for the year ended Dec. 31, 1904, the company having been merged into the Vandalia Railroad on January 1. Gross earnings were $1,205,804, a decrease of $55,134 from 1903. Operating expenses were $1,031,658, leaving net earnings of $174,146, a decrease of $50,124 compared with 1903. The net income was $31,559 against a deficit of $6,089 in 1903, an increase of $37,648. The earnings from freight traffic for the year were $860,999, a decrease of $104,200 from 1903. Passenger traffic, at the same time, increased $48,267, or 19 per cent. over the previous year, due to the Louisiana Purchase Exposition at St. Louis. Expenses as a whole decreased $5,010 during 1904, there being a decrease of $19,904 in maintenance of equipment expenses resulting from decreased freight mileage and a pool rate for repairs. There were also increases of $11,775 in maintenance of way, due to floods in the early part of the year, of $2,720 in conductinng transportation, and of $3,080 in general expenses. There was a decrease of 126,695 tons in the amount of bituminous coal carried, which was 661,157 tons during the year. The total tonnage carried was 1,393,786 tons, a decrease of 196,975 tons, as compared with 1903. Passenger earnings were 25 per cent. of the total earnings against 20 per cent. in 1903. At the same time, the number of passengers carried decreased 15,477, being 551,956 in 1904, and the number of passengers carried one mile increased 2,226,672, being 15,081,913 in 1904. See Logansport & Toledo.

TOLEDO, ST. LOUIS & WESTERN.—On account of the expiration on July 1 of the voting trust, this company has applied to the New York Stock Exchange to list the entire $10,000,000 common and $10,000,000 preferred stock. This is a preliminary step to calling in the voting trust certificates.

VANDALIA.—Speyer & Co. are offering at 103½ the unsold part of $7,000,000 of this company's consolidated-mortgage 4 per cent. gold bonds. These are part of series A consisting of $10,000,000, which is part of the total authorized issue of $25,000,000. The whole is a first lien on 158 miles of line from East St. Louis to the Indiana state line, and on 93 miles of line from Logansport to Butler, Ind.; and a lien, subject only to $4,700,000 underlying bonds, on the remaining 590 miles.

WABASH-PITTSBURG TERMINAL.—This company has applied to the New York Stock Exchange to list an additional $2,000,000 first-mortgage 4 per cent. bonds of 1954.

WASHINGTON TERMINAL.—Brown Bros. & Co., Alexander Brown & Sons and Harvey Fisk & Sons are offering at 97½ the unsold part of the $10,000,000 3½ per cent. first-mortgage gold bonds of 1945 of this company guaranteed by the Baltimore & Ohio and the Philadelphia, Baltimore & Washington. These are part of an authorized issue of $12,000,000, the remaining $2,000,000 being reserved for betterments and extensions. Of the $5,000,000 authorized capital stock of the terminal company, $2,500,000 has been issued, half to each of the two roads named.

WEST PENN RAILWAYS.—N. W. Halsey & Co., of New York, are offering $2,500,000 first-mortgage 5 per cent. gold bonds of 1931 of the West Penn Railways Co., which owns and operates 95 miles of interurban electric lines and serving a population of 200,000 in the Connellsville coal and coke district. Electric lighting is also supplied in 34 communities.

WISCONSIN & MICHIGAN.—The stockholders of the company will, on June 12, vote on increasing the capital stock to $5,000,000. The road runs from Peshtigo, Wis., north to Iron Mountain, Mich., 73 miles, with about 40 miles of branches. It also operates car ferries from South Chicago to Peshtigo Harbor. The object of the increase of stock is to extend the road from Iron Mountain to Superior and to Norway. The present amount of stock is $951,500.